Approved June 18, 1987
Date

MINUTES OF THE House COMMITTEE ON Transportation.

The meeting was called to order by Rex Crowell (Chairperson) at

1:30 ~~a.m.~~/p.m. on February 19, 1987 in room 519-S of the Capitol.

All members were present except: Representatives Justice, Campbell and Sutter

Committee staff present:
Bruce Kinzie, Revisor of Statutes
Hank Avila, Legislative Research
Donna Mulligan, Committee Secretary

Conferees appearing before the committee:

Ms. Deb Miller, Kansas Department of Transportation
Mr. John Bottenberg, Kansas Ethanol Association
Dr. Arlan Hicks, Kansas Department of Transportation

The meeting was called to order by Chairman Crowell and the first order of business was a presentation by the Kansas Department of Transportation on their Highway Cost Allocation Study.

Ms. Deb Miller, Kansas Department of Transportation, said the Highway Cost Allocation Study was based on the four year study period of FY-1985 through FY-1988. (See Attachment 1)

Dr. Arlan Hicks, Kansas Department of Transportation, said the Kansas study allocated the projected construction, maintenance, and administrative expenditures for the four year study period of 1985-1988 to the different classes of vehicles. Dr. Hicks went over the study in detail with the Committee. (See Attachment 2)

The next order of business was a bill request.

Mr. John C. Bottenberg, Kansas Ethanol Association, requested that legislation be introduced which would provide an incentive for gasoline blenders to use Kansas produced ethanol in Kansas. (See Attachment 3)

A motion was made by Representative Spaniol that this legislation be introduced. The motion was seconded by Representative Adam. The motion passed.

The next business was on HB-2026 concerning bonding requirements for vehicle dealers and vehicle brokers.

A motion was made by Representative Sallee that HB-2026 be tabled. The motion was seconded by Representative Adam. The motion passed.

A motion was made by Representative Spaniol to introduce legislation adding a 3¢ diesel tax increase in the state of Kansas and earmark the revenue for new highway construction.

Committee discussion ensued.

The motion failed 11-3 on a division.

The meeting was adjourned at 2:35 p.m.

Rex Crowell, Chairman

COMMITTEE: Transportation

DATE: 2-1_-87

PLEASE PRINT

NAME	ADDRESS	COMPANY/ORGANIZATION
Arland Hicks	Topeka	Kansas Dept of Transp
Shelley Sutton	Topeka	Ks. Engineering Soc.
Marye Cunningham	Topeka	Ks. Motor Carriers Assn
Tom Whitaker	Topeka	Ks Motor Carriers Assn
Deb Miller	Topeka	KDOT
Dennis R Slimmer	Topeka	KDOT
Kathryn Farrell	Topeka	KDOT
GARY L. BLACKWOOD	Allen County	WASHBURN UNIV.
Patrick R. Hubbell	Topeka Kansas Railroad Association	Kans RR
CHARLES BELT	WICHITA	WICHITA AUTO DEALERS ASSOC.
JIM SULLINS	TOPEKA	KS MOTOR CAR DEALERS ASSN.
JOHN BOTTENBERG	TOPEKA	KS ETHANOL ASSOC
ED DESOIGNIE	TOPEKA	KS. DEPT. OF TRANSP.
Leroy Jones	Overland Park	B.L.E.
RON CALBERT	NEWTON	U.T.U.

Highway Cost Allocation Study

A Tax Equity Question

Does Everyone Pay Their Fair Share?

Attach. 1

THREE COMPONENTS

1. HOW MUCH SHOULD THEY PAY? (COST ALLOCATION)
2. HOW MUCH DO THEY PAY? (REVENUE ATTRIBUTIO
3. HOW DO THEY COMPARE? (EQUITY)

BACKGROUND

NATIONAL STUDY

- MANDATED BY CONGRESS 1978 STAA
- COMPLETED 1982
- EQUITY RESOLUTION IN 1982 STAA

BACKGROUND

STATE STUDIES

__19__ STATES COMPLETED STUDIES

__2__ STATES IN PROCESS

BACKGROUND

KANSAS STUDY—

- 1979 LEGISLATIVE – DETERMINE IMPACT OF HEAVY VEHICLE ON PAVEMEN
- 1981 INTERIM – KDOT TO D(MAJOR COST ALLOCATION STUDY –
- 1985 – STUDY DRAFT COMPLETE (SEPTEMBER) 85

COST ALLOCATION

HOW TO ALLOCATE HIGHWAY EXPENDITURES TO THE VARIOUS VEHICLE GROUPS FOR THE FOUR YEAR STUDY PERIOD

FY 1985 - FY 1988

Highway EXPENDITURES

- Construction
- Maintenance
- Administration
- Engineering
- Vehicle Weight Enforceme
- Vehicle Registration

		GVW	ESAL
CARS		3,000	0.0002
PICK-UPS/VANS		12,000	0.06
TRUCKS, SINGLE UNIT	S2	33,000	1.9
	S3	47,000	1.4
TRUCKS, COMBINATION UNIT	3-S2	80,000	2.3
	2-S1-2	80,000	4.0
OTHER			
BUSES			
MOTORCYCLES			

REF. PAGE E21, FEDERAL HCAS

Types of Costs

* COMMON
* ATTRIBUTABLE
* OVERHEAD

Common Costs

SHARED BY ALL VEHICLES EQUALLY ON THE BASIS OF USE.

Attributable Costs

SHARED BY VEHICLE CLASSES ON BASIS OF VEHICLE CHARACTERISTICS

* WEIGHT
* WIDTH
* AXLE SPACINGS

Overhead COSTS

SHARED BY ALL VEHICLE CLASSES ON BASIS **OTHER** THAN USE OR VEHICLE CHARACTERISTICS.

Vehicle Costs

TYPE	SHARE
CARS	39
PICK-UPS/VAN	19
SINGLE UNIT S2 SINGLE UNIT S3	10
COMBINATION UNIT 3-S2 COMBINATION UNIT 2-S1-2	31
OTHER BUSES MOTORCYCLES	1

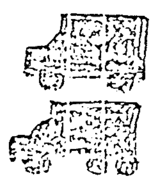
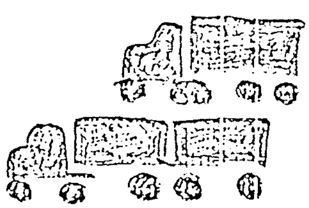
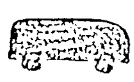
– REVENUE ATTRIBUTION –

HOW MUCH DO EACH OF THE VEHICLE GROUPS CONTRIBUTE TO THE TOTAL REVENUE.

REVENUE

- MOTOR FUEL TAX
- VEHICLE REGISTRATION
- SALES TAX TRANSFER
- MISCELLANEOUS

PERCENT ATTRIBUTED BY TAX

VEHICLE GROUPS	MOTOR FUEL TAX	VEHICLE REGISTRATION	SALES TAX	MISC.	TOTA
CARS 	43%	35	69	61	4
PICK-UPS/ VANS 	24%	17	25	22	2
SINGLE UNIT TRUCKS 	10%	10	1	5	9
COMBINATION UNIT TRUCKS 	22%	36	02	7	2
OTHER BUS   MOTORCYCLE	1%	2	5	5	2
	100%	100%	100%	100%	100%

EQUITY

HOW DO THE REVENUES ATTRIBUTABLE TO EACH CLASS COMPARE TO THE COST ALLOCATED TO EACH GROUP:

$$\frac{\text{REVENUE ATTRIBUTABLE}}{\text{COSTS ALLOCATED}}$$

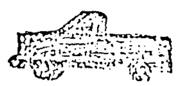
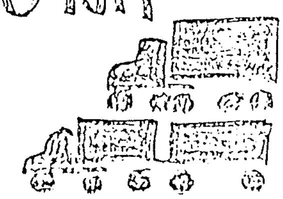
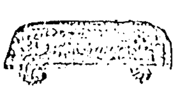
WHERE EQUITY = 1.0

UNDERPAYMENT = < 1.0

OVERPAYMENT = > 1.0

BETWEEN GROUP EQUITY

DOES EACH GROUP PAY ITS SHARE.

VEHICLE	EQUITY VALUE
* CARS 	1.13
* PICKUPS/VANS 	1.11
* TRUCKS, SINGLE UNIT 	0.93
* TRUCKS, COMBINATION UNIT 	0.79
* OTHER BUS  MOTORCYCLE 	1.15

WITHIN GROUP EQUITY

DO ALL THE VEHICLES WITHIN A GROUP PAY UNIFORM SHARE

OUTCOME

LOW MILEAGE VEHICLES GENERALLY PAY A GREATER SHARE THAN HIGH MILEAGE VEHICLES.

PROBLEMS & ISSUES

1. ARE STUDY TECHNIQUES VALID
   - + KDOT INTERNAL CONSENSUS
   - + REVIEWED BY MULTIPLE GROUPS.
     - AMERICAN ASSOCIATION OF RAILROADS
     - AMERICAN TRUCKING ASSOCIATION
     - KANSAS MOTOR CARRIER ASSOCIATION
     - AMERICAN AUTOMOBILE ASSOCIATION
     - OTHER HIGHWAY AGENCIES (STATES & FEDERAL)
   - + LITTLE DEVIATION FROM FEDERAL STUDY.

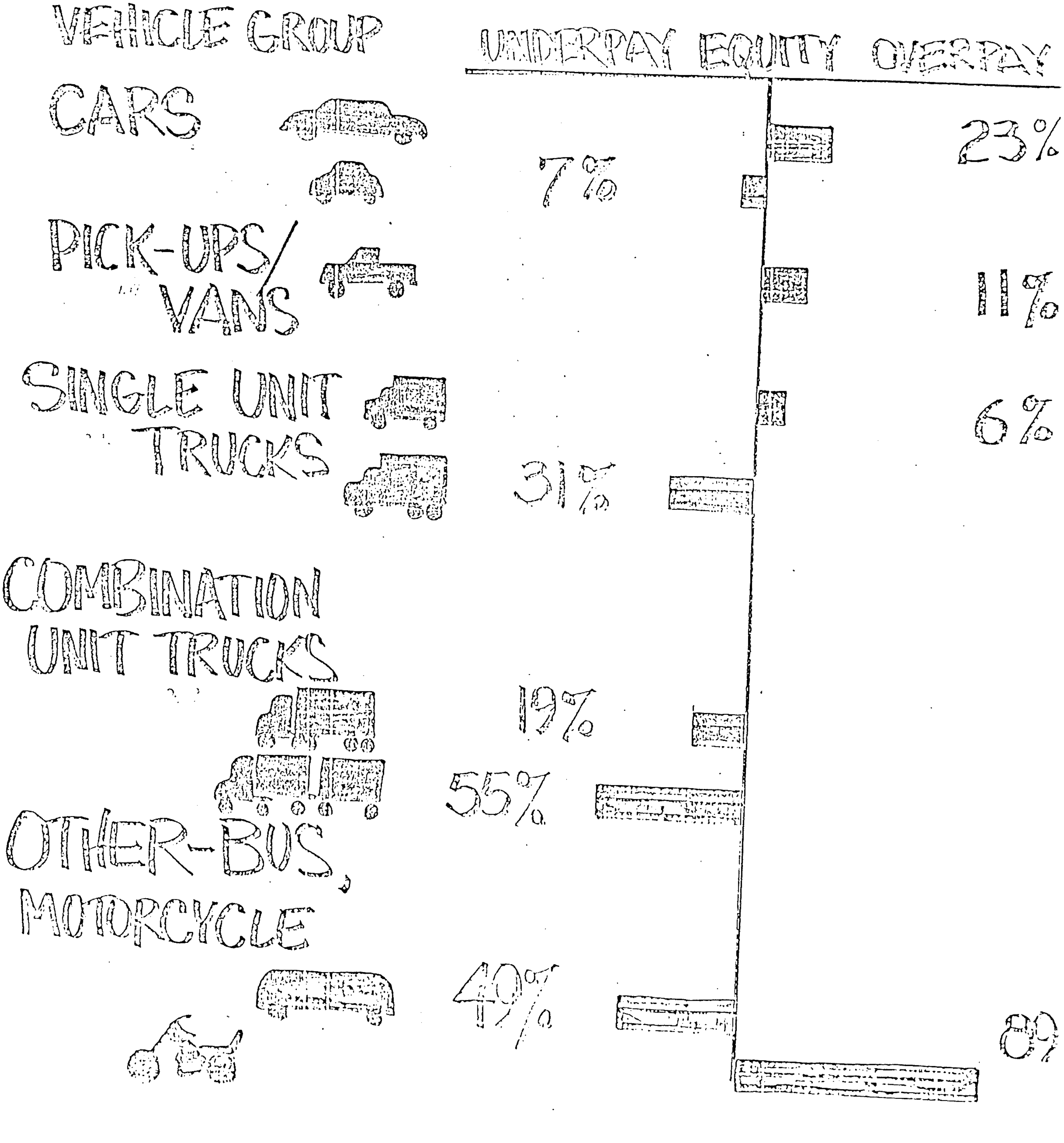
2. DATA ASSIGNMENTS TO VEHICLE GROUPS

- VEHICLE REGISTRATION (REVENUE) ARE BY WEIGHT INSTEAD OF BY VEHICLE TYPE (COSTS)

3. SALES TAX TRANSFER

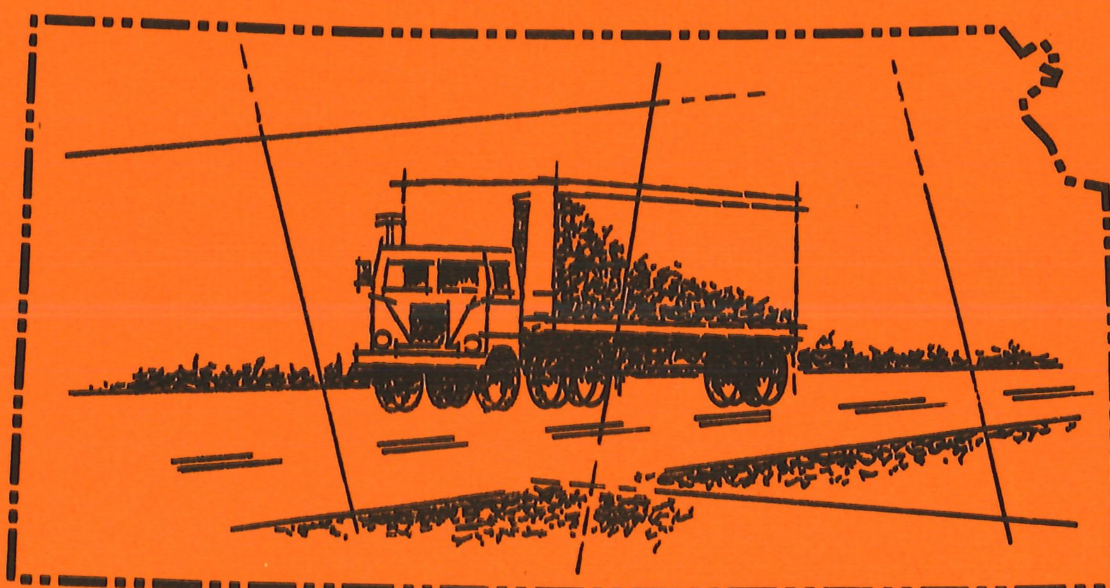
* PURCHASES BY UTILITIES ARE EXEMPT FROM SALES TAX.
* INTERSTATE COMMON CARRIER TRUCKI[illegible] FIRMS ARE CLASSIFIED AS UTILITIES.
* INTERSTATE LEASES FOR COMMON CARRIERS ARE EXEMPT FROM SALES TAX.

4. STUDY RESULTS



COST ALLOCATION

1985 STUDY



DEPARTMENT OF TRANSPORTATION
KANSAS

Attach. 2

KANSAS HIGHWAY COST ALLOCATION STUDY

by

Arland V. Hicks, Task Force Leader
Division of Planning and Development

Mokhtee Ahmad, Chief
Office of Analysis and Evaluation

G. David Comstock, Staff Engineer
Bureau of Construction and Maintenance

Richard L. McReynolds, Assistant Pavement Management Group Leader
Geotechnical Unit

Ken Stodgell, Special Projects Coordinator
Office of the Secretary of Transportation

in cooperation with the
U.S. Department of Transportation
Federal Highway Administration

September 1985

PREFACE

The Kansas Cost Allocation Study was conducted by a special task force appointed by the Secretary of Transportation. Five professional disciplines within the Kansas Department of Transportation were represented. The task force first prepared a draft of "Selection of Cost Allocation Techniques". The draft was conceptual in that it identified and described the allocation techniques to be used in the cost allocation study. The draft was then subjected to an intensive internal review by KDOT's executive management, division directors, bureau chiefs, and district engineers. The initial draft was rewritten incorporating the suggestions received from the internal review process. The rewritten draft was then distributed to interest groups, members of the Kansas House and Senate Transportation Committees, and selected states for review and comment. Once again, changes were made incorporating results of the external review. The revised draft is now Chapter 1 of the Cost Allocation Study. Changes incorporating suggestions from both internal and external reviews are listed at the conclusion of Chapter 1.

Allocation techniques developed and implemented in Chapter 1 were then used to allocate projected expenditures for the study period of 1985 through 1988. Allocated expenditures were computed both in terms of dollar amounts and percentage shares to the various classes of vehicles used in the study. Chapter 2, "Allocation of Expenditures", discusses the allocated expenditures, and lists the dollar amounts and percentage shares of the various classes of vehicles.

Chapter 3, "Attribution of Revenues", identifies the revenue sources for which projections will be needed. The next step was to develop a methodology for attribution of revenues. Chapter 4, "Projected Revenues and Cost Responsibility", utilizes the methodology developed in Chapter 3 to attribute the projected revenues from the various vehicle classes used in the study both in dollar amounts and percentage shares of the various vehicle classes. In addition, Chapter 4 displays ratios of user charges paid to cost responsibility. User charges paid are the attributed revenues. Cost responsibility is the allocated expenditures. The comparison of the two is a ratio of percentages of user charges paid to percentages of cost responsibility. A ratio below 1.00 indicates that a vehicle class is paying less than its share. Anything above 1.00 indicates that a vehicle is paying more than its share.

A draft copy was made available to interest groups, and members of the Kansas House and Senate Transportation committees. Extensive comments were received from the Kansas Railway Association and the Kansas Motor Carriers Association. Comments received are shown in full in Appendix I, "Comments from Interest Groups." The task force's responses to the interest groups are in Appendix J, "Summary of Interest Group Comments".

blank page on purpose

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

blank page on purpose

EXECUTIVE SUMMARY

A Highway Cost Allocation Study is a study of tax equity. Specifically, the Kansas Highway Cost Allocation Study addresses the equity of state-collected revenues as they relate to the cost responsibility for the State highway system. As such, state-collected revenues distributed to local governments were not included as revenues. Neither are Federal-Aid funds included as revenues because those funds have already been allocated in the 1982 Federal Highway Cost Allocation Study.

The Kansas Highway Cost Allocation Study was requested by the Kansas Legislature. Legislative interest in cost allocation began during the 1979 legislative session when the House Ways and Means Committee proposed that the Secretary of Transportation prepare a report on highway deterioration caused by heavy vehicles in the six highway districts. The 1980 and 1981 interim transportation committees held hearings and discussions on highway cost allocation studies. At that time Secretary Kemp informed the committees that the Kansas Department of Transportation would conduct a study but requested that time be given for consideration of the results of the Federal Highway Cost Allocation Study, specifically the methodologies recommended for use by the States. The Federal Cost Allocation Study was completed May 1982. The State Highway Cost Allocation Guide was completed October 1984. Those documents provided considerable guidance and data for the Kansas Highway Cost Allocation Study.

The Kansas Study allocated the projected construction, maintenance, and administrative expenditures for the four year study period of 1985-1988. The expenditures were allocated to 38 classes of vehicles which included automobiles, motorcycles, buses, pickups and vans, light single unit trucks, heavy single unit trucks, and truck tractors with trailers. These general types were subdivided into registration weight groups and numbers of axles. Revenues were restricted to taxes and fees distributed to the State Highway and State Freeway Funds. The projected revenues for the four year study period of 1985-1988 were attributed to the same 38 classes of vehicles used for expenditure allocation.

Revenues and expenditures were compared for each of the 38 classes of vehicles. The comparison is a ratio of percentages of revenues to percentages of expenditures. A ratio below 1.00 indicates that a vehicle class is underpaying. A ratio above 1.00 indicates that a vehicle class is overpaying. The ratios for passenger vehicles and trucks are 1.12 and 0.82 respectively. Passenger vehicles are overpaying by 12% and trucks are underpaying by 18%. However, there are inequities within passenger cars and trucks. The small autos are subsidized by large autos and pickups and vans. The light truck class (2 axle and 6 tires) overpay by 6% but the lighter trucks subsidize the heavier trucks. The heavy single unit 3 axle truck class underpay by 33%. The truck tractor twin trailer registered above 75,000 pounds underpays by 55% whereas a 5 axle truck tractor single trailer also registered above 75,000 pounds underpays by 11%. The following general conclusions summarize the study:

1. Passenger vehicles subsidize trucks.
2. Pickups, vans and standard autos subsidize small autos.
3. Light single unit trucks (2 axles with 6 tires) subsidize heavier trucks.
4. Heavy single unit trucks (3 axles) underpay by 33%.
5. Heavy combination 5 axle truck-single trailers subsidize 5 axle truck twin trailers.

blank page on purpose

CHAPTER 1
SELECTION OF COST ALLOCATION TECHNIQUES

INTRODUCTION

This document provides an overview of the technical considerations and cost allocators which have been proposed for the Kansas Highway Cost Allocation Study.

THEORETICAL CONSIDERATIONS

One of the goals of a highway cost allocation study is to develop measurement criteria for allocating highway costs. The 1982 Federal Highway Cost Allocation Study (FHCAS) used efficiency and equity as the primary criterion. The efficiency approach involves a development of an action to provide maximum benefit to society at some given cost or minimum cost to society for some given benefit. On the other hand, the equity approach is concerned with the distribution of costs and benefits among groups within society. The equity criterion was selected to be the primary goal in the FHCAS after a determination that the efficiency criterion was incompatible with the constraints imposed by legislation, data availability, highway finance tradition, and the administrative problems associated with collecting and enforcing Federal user charges. Incompatibility also exists at the state level. Consequently, the Kansas Highway Cost Allocation Study (KHCAS) will use equity as the principal basis for allocating Kansas highway cost and user charges.

Even though the efficiency criterion is not being considered as the primary basis for allocating costs in this study, a discussion of this criterion will be presented both for its theoretical appeal and its potential use in future studies. If desired, the reader may proceed to the equity section without any loss in continuity.

EFFICIENCY

Efficiency, from a highway cost allocation viewpoint, involves an allocation of society's available resources among transport users within and/or between modes in order to extract maximum net benefit from available resources. The microeconomic rule for efficient pricing is that users be charged a price equal to marginal cost. Price represents a measure of value of an additional unit of consumption, while marginal cost is a measure of additional resource cost to society for consumption of that additional unit. If price is less than marginal cost, the user may not value the usage as much as society values the resources that are being consumed; and if price is higher than marginal cost, then some potential users are deterred even though they would benefit more than it costs society.

Efficiency can be discussed in terms of short-run and long-run analysis. The difference in the definition of these two economic time periods is that short-run is characterized by both fixed and variable costs, while all costs are variable in the long-run. Fixed costs are those that remain constant when existing highways are subjected to varying rates of use. For example, the cost of right-of-way for existing highways remains fixed even though the amount of traffic on the highway varies. Variable costs are those that vary with usage. For example, highway use damages pavements and gives rise to the cost of of numbers of vehicles. In addition, there is no assurance that the use of ton miles to distribute weight function costs assigns to heavy vehicles the full costs of required design features.

The incremental solution is most frequently used and has been selected for this study. This method allocates cost responsibility on the basis of design factors. The methodology begins with the concept of a basic road which has minimum width and strength to provide service to a minimum number of basic vehicles. Successive design features and associated costs are then added to meet requirements of progressively heavier and larger vehicles. The basic service roadway used in this study will be a minor collector with a full service roadway being a principal arterial. Table 1 lists minimum design dimensions currently considered by the Kansas Department of Transportation for basic service roadways (minor collectors) and for full service roadways (principal arterials). These dimensions will be utilized later in the study in the development of cost allocation procedures.

TABLE 1

MINIMUM DIMENSIONS FOR BASIC AND FULL SERVICE ROADWAYS

ITEM	BASIC SERVICE ROADWAY (MINOR COLLECTOR)	FULL SERVICE ROADWAY (PRINCIPAL ARTERIAL)
Traffic volume	less than 400 AADT*	greater than 3,000 AADT*
Traffic type	Primarily automobile, pickups and vans	Mixed-includes all vehicles
Pavement thickness	6"	Determined by design
Pavement lane width	11'	12'
Shoulder width	4'	8'
Roadway width	30'	40'
Bridge width	28'	40'
Bridge design increment	H5	HS20

*AADT = Annual Average Daily Traffic
Source: Project Selection Criteria April 14, 1983

STUDY PARAMETERS

The cost allocation study will be limited to the approximate 10,000 miles of the state highway system. City Connecting Links, although not a part of the rural state highway system, are included because the Kansas Department of Transportation provides part of the funds used in construction and maintenance of city connecting links.

Study period will include the fiscal years 1985, 1986, 1987 and 1988. A four year period is an optimum time period. Vehicle mixes and geometric design standards remain relatively stable. The four year period is sufficient time for changes in tax collection instruments and procedures. In addition, it provides sufficient time to react to changes in energy supplies.

Vehicle classes to be used in the study will be a merger of the federal vehicle classes and the Kansas motor vehicle registration classes. The federal vehicle classes measure vehicle weight ranges, number of axles and axle loadings. These vehicle characteristics are used in pavement and bridge design and are essential for allocating costs. The Kansas motor vehicle registration classes are weight oriented without reference to number of axles or axle loadings and are used only for revenue purposes. In addition, the Kansas motor vehicle registration classes are subdivided into use classes. Table 2 lists the federal vehicle classes showing the vehicle configurations and weights which will be used in allocating costs. Table 3 lists the Kansas tax structure for vehicle registrations. Vehicle width is important in allocating additional costs incurred because of wider vehicles. Table 4 divides the Federal vehicle classes into basic width and additional width vehicles so that additional costs incurred by wider vehicles can be fairly allocated.

EXPENDITURES

Expenditures to be allocated will be limited to state funds. Federal aid funds are excluded because they are already allocated in the FHCAS. The entire KDOT budget will be allocated. This will include construction, maintenance, administration, engineering and design, freeway debt service, and statutory disbursements. The cost allocation study does not guarantee that each vehicle class is paying its full share of highway costs. A cost allocation study only allocates expenditures. If the budget is less than actual need, it is still equitably allocated. However, the resulting "using up" of the system subsidizes present traffic at the expense of future traffic. Table 5 lists the allocators which will be used in the Kansas study. The rationale for selection of cost allocators will be discussed later in the study.

OVERHEAD, COMMON AND ATTRIBUTABLE COSTS

This cost allocation study will categorize the direct governmental costs into overhead, common and attributable costs. Costs either not affected or only marginally by changes in vehicle travel are referred to as "overhead costs". The costs of the basic service roadway are referred to as "common costs" and are shared by all vehicles using the roadway. Costs required for additional roadway features necessary to accommodate larger and heavier vehicles are referred to as "attributable costs" and are allocated to vehicle classes requiring additional roadway features. Allocation of common costs measures the need for a roadway facility and is not related to weight, width or other vehicle characteristics. Relative need for a roadway facility can utilize characteristics common to all vehicles. These would include vehicle numbers, vehicle miles and modified measures of vehicle travel such as axle miles and passenger car equivalent miles. Allocation of attributable costs measures the relative need for additional roadway features that are occasioned by characteristics specific to certain vehicle classes, i.e., weight, axle loadings and width. These characteristics become measures of relative use when multiplied by vehicle miles traveled by specific vehicle classes.

COST ALLOCATORS

The number of vehicles (N) allocator considers each vehicle as a unit and proportions costs equally to each vehicle. High and low mileage vehicles would pay the same.

The vehicle miles traveled (VMT) allocator measures the travel of each vehicle. It is the basic measure of travel, has been used traditionally, and is easily understood and accepted. Since all vehicles pay equally on the basis of travel, the VMT cost allocator would not change the pattern of highway use.

The axle miles traveled (AMT) allocator is a modified version of vehicle miles traveled (VMT). It measures both use and the space occupied by a vehicle. The space occupied is measured by the numbers of axles per vehicle. A tandem axle is considered to be two axles. The AMT cost allocator is then the product of VMT and the number of axles per vehicle. Since axles and axle loadings are used as design parameters in pavements and bridges, the AMT allocator can reflect design needs. Since vehicles would pay on the basis of number of axles and miles of travel, vehicles with more axles would pay more. This would encourage a reduction in number of axles per vehicle which would increase pavement and bridge stresses potentially resulting in the premature wearing out of the road or failure of the structure(s).

The passenger car equivalent - vehicle miles traveled (PCE-VMT) allocator converts all vehicles to an equivalent number of passenger cars. The conversion is based on traffic density, roadway profile, and bridge and pavement widths. The PCE-VMT allocator is the product of the passenger car equivalent and the miles traveled per vehicle. The PCE value per vehicle varies with traffic density, roadway profile and pavement and shoulder widths. It was considered but not used in the FHCAS. It will not be used in this study and is presented for information only.

The ton miles traveled (TMT) allocator measures both use and operating vehicle weight. It is the product of operating vehicle weight and vehicle miles traveled. Even though it is weight oriented, it does not include axle loadings. Since vehicles would pay on the basis of weight and travel, there would be little incentive to encourage use of additional axles to distribute vehicle weight thereby reducing pavement and bridge stresses. Vehicle weight and axle loadings would need to be enforced through penalties rather than through economic incentives.

Equivalent single axle loading-vehicle miles traveled (ESAL-miles) cost allocator is based on a conversion of all axle loadings to an equivalent 18,000 pound single axle loading in conjunction with vehicle use. The equivalency concept was developed in the American Association of State Highway Officials (AASHO) road test and is used in pavement design. ESAL values increase exponentially with axle loadings. Since vehicles would pay on the basis of ESAL and amount of travel, there is a strong incentive to increase the number of axles and decrease the magnitude of axle loadings, thereby extending the roadway life.

TABLE 2

FEDERAL VEHICLE CONFIGURATIONS AND REGISTERED WEIGHTS (POUNDS)

VEHICLE CLASS

Automobiles
- Standard
- Small

Motorcycles

Buses
- Intercity
- Transit
- School

Single unit 4-tired truck
- 5,999 or less
- 6,000 to 10,000
- More than 10,000

Single unit 6-tired truck
- 19,499 or less
- 19,500 to 26,000
- More than 26,000

Single unit 3-axle truck
- 25,999 or less
- 26,000 to 33,000
- 33,001 to 40,000
- 40,001 to 50,000
- More than 50,000

Combination unit - 3 axle
- 25,999 or less
- 26,000 to 50,000
- More than 50,000

VEHICLE CLASS

Combination unit - 2S2
- 49,999 or less
- 50,000 to 60,000
- More than 60,000

Combination unit - 4 axle
- 49,999 or less
- 50,000 to 60,000
- More than 60,000

Combination unit - 3S2
- 49,999 or less
- 50,000 to 70,000
- 70,001 to 75,000
- More than 75,000

Combination unit - 5 axle
- 49,999 or less
- 50,000 to 70,000
- 70,001 to 75,000
- More than 75,000

Combination unit - 6+ axle
- 49,999 or less
- 50,000 to 70,000
- 70,001 to 75,000
- More than 75,000

Total Classes - 38

TABLE 3

KANSAS TAX STRUCTURE FOR VEHICLE REGISTRATIONS

VEHICLE TYPE	GROSS VEHICLE WEIGHT (GVW POUNDS)	REGULAR FEES	6,000 MILES AND LOCAL	FARM FEES
Motorized Bicycles		$ 5.50		
Motorcycles		$ 10.50		
Automobiles	3,000 or less	$ 13.50		
	3,001 to 3,999	$ 16.75		
	4,000 to 4,500	$ 20.00		
	more than 4,500	$ 26.50		
Electric Vehicle		$ 7.00		
Tax Unit Owned		$ 2.50		
Trucks	12,000 or less	$ 25.50		
	12,001 to 16,000	$ 75.50	$ 47.50	$ 25.50
	16,001 to 20,000	$ 100.50	$ 75.50	$ 30.50
	20,001 to 24,000	$ 150.50	$100.50	$ 42.50
	24,001 to 30,000	$ 235.50	$135.50	
	30,001 to 36,000	$ 285.50	$160.50	
	36,001 to 42,000	$ 360.50	$185.50	
	42,001 to 48,000	$ 460.50	$235.50	
	48,001 to 54,000	$ 615.50	$315.50	
	54,001 to 60,000	$ 765.50	$360.50	$150.50
	60,001 to 66,000	$ 915.50	$440.50	$300.50
	66,001 to 74,000	$1,175.50	$575.50	
	74,001 to 80,000	$1,325.50	$675.50	
	80,001 to 85,000	$1,475.50	$775.50	
	24,001 to 54,000			$ 62.50
	More than 66,000			$500.50
Trailers	2,000 or less	$ 10.50		
	2,001 to 8,000	$ 10.50		
	8,001 to 12,000	$ 15.50		
	More than 12,000	$ 25.50		
Buses	8 to 30 Passengers	$ 15.50		
	31 to 39 Passengers	$ 30.50		
	More than 39 Passengers	$ 60.50	Total Classes - 30	

TABLE 4

KANSAS VEHICLE CLASSES BY VEHICLE WIDTH

BASIC WIDTH VEHICLE CLASSES	ADDITIONAL WIDTH VEHICLE CLASSES
Automobiles	Buses
Motorcycles	Single unit trucks - 6 tire
Single unit trucks - 4 tired	Single unit trucks - 3 axle
	Combination trucks - 3 axle
	Combination trucks - 2S2
	Combination trucks - 4 axle
	Combination trucks - 3S2
	Combination trucks - 5 axle
Total Classes - 12	Combination trucks - 6+ axle

TABLE 5
KANSAS COST ALLOCATORS

EXPENDITURE CATEGORY	VEHICLES: ALL	VEHICLES: WIDER	VEHICLES: HEAVIER	ALLOCATORS: VMT	ALLOCATORS: ESAL MILES	ALLOCATORS: AMT	ALLOCATORS: TMT	ALLOCATORS: N	COMMENTS
Right of Way, Grading and Drainage	X			93%					
		X		7%					
Pavement & Overlay:									
Minimum Pavement Thickness	X			91.67%					
		X		8.33%					
Additional Pavement Thickness	X				91.67%				
		X			8.33%				
Shoulders	X			50%					
		X		50%					
New Bridges	X					52.31%			
		X		33.81%					
			X	13.88%					
Replacement Bridges:									
First Part	(see comment)			X					Vehicles heavier than weight carrying capacity of replaced bridge.
Remainder	(see comment)								Same as new bridges.
Bridge Repairs or Rehabilitation	X					X			
Miscellaneous Construction	X			X					
Maintenance:									
Overhead Costs	(see comment)								Prorated to Maintenance Common and Attributable Costs
Common Costs	X			X					
Attributable Costs	X						X		
Administration	(see comment)								Overhead Costs Prorated to Construction, Maintenance, and other attributable activities
Freeway Debt Service	(see comment)			(see comment)					Assigned on basis of separate study.
Statutory Disbursements:									
Motor Carrier Inspection Bureau	(see comment)			X					Vehicles inspected by Bureau
Driver Licensing	X							X	
Vehicle Registration	X							X	

VMT - Vehicles miles traveled.
ESAL Miles - Equivalent single-axle miles traveled.
AMT - Axle-miles traveled.
TMT - Ton-miles traveled.
N - Number of Vehicles.

RIGHT-OF-WAY, GRADING AND DRAINAGE

Right-of-way, grading and drainage are interrelated. Right-of-way is a strip of land which provides space for the roadway system. Grading is the combination of excavation and embankment necessary for the framework and support of pavements, shoulders and bridges. Drainage includes the portion of grading and the installation of culverts necessary for removal of excess water. The magnitude of right-of-way, grading and drainage is primarily dependent on lane and shoulder widths, and secondarily dependent on profile grade. The effect of lane and shoulder widths and profile grades will be discussed separately.

Grading and right-of-way widths are affected most by roadway widths (lanes plus shoulders). A comparison of prototype designs of basic and full service roads showed that the basic service road is responsible for 93 percent of grading costs of a full service road. The remaining 7 percent is the responsibility of wider vehicles requiring wider roadway widths. Wider vehicles are listed in Table 4.

The FHCAS explored in considerable detail the relationship between natural terrain grades and roadway profile grades. If vehicles had more power and better stopping abilities, roadway profile grades could be steeper thereby reducing excavation, embankment and right-of-way width. The FHCAS classified terrain as flat, rolling and mountainous. Kansas' terrain is 90 percent flat and ten percent rolling. The 90 percent flat terrain does not require any special attention for profile grades to satisfy needs of all vehicles. The remaining ten percent rolling terrain conceivably might require some profile grade adjustment and/or climbing lanes. Climbing lanes are generally considered to be for trucks. However, since Kansas currently signs climbing lanes with a "SLOWER VEHICLES KEEP RIGHT" sign, the climbing lanes are intended for both cars and trucks. KDOT's Bureau of Design found only two instances during the past five years when climbing lanes had been provided. In their opinion, climbing lanes are an insignificant portion of the overall construction program.

Where climbing lanes are not constructed in rolling terrain, the profile grade requires adjustment to minimize speed reduction of vehicles traveling up steeper grades. This adjustment may require additional excavation, embankment and right-of-way width. The question is how to identify the vehicle classes with high weight to horsepower ratios requiring flatter profile grades. Vehicles with high weight to horsepower ratios are usually heavy trucks. However, low horsepower subcompact automobiles also have high weight to horsepower ratios and also experience speed reduction on steeper grades. Both heavy trucks and subcompact automobiles benefit from flatter profile grades as well as other vehicles in the same traffic stream which are not delayed. Even though profile grade may require special attention during the design process in rolling terrain, any additional costs appear to be shared by various vehicle classes. Therefore, from a cost allocation perspective in Kansas, profile grade is not a problem requiring a special allocation technique.

The vehicle miles traveled (VMT) allocator was selected for allocating right-of-way costs. The VMT allocator is the basic measure of travel and is appropriate when cost is generally related to the need to accommodate travel. Each vehicle class is allocated an equal cost per mile traveled. Right-of-way, grading and drainage costs, from a cost allocation perspective, are not affected by vehicle weight, but are affected by vehicle width. Vehicles requiring additional width should pay those costs. The procedure for allocating costs of right-of-way, grading and drainage will be performed as follows:

1. All classes of vehicles will be responsible for 93 percent of the costs of right-of-way, grading and drainage on the basis of VMT. The 93 percent value represents the ratio of right-of-way, grading and drainage costs between a basic service roadway and a full service roadway and was discussed earlier.

2. Wider vehicles, as listed in Table 4, will be responsible for 7 percent of the costs of right-of-way, grading and drainage. The 7 percent value represents the portion of right-of-way, grading and drainage required for wider vehicles and was discussed earlier.

Even though VMT was selected as the appropriate cost allocator, other cost allocators were considered. The allocators of axle miles traveled (AMT) and passenger car equivalents-vehicle miles traveled (PCE-VMT) are measures of travel that are non-weight related. They also measure relative space occupied during a vehicle's use of the roadway system. The PCE-VMT allocator considers such things as weight-to-horsepower, width and inhibiting effects on other traffic. These multiple factors are used to develop a passenger car equivalency value. For example, a large vehicle may be considered to have the same effect on travel as several automobiles. The PCE value is not constant but varies with traffic density, roadway profile and pavement and bridge widths. The other conceptually acceptable but not selected allocator, axle miles traveled (AMT), is constant and easily measured. A reasonable correlation exists in that each allocator converts vehicles to passenger car equivalencies. A typical PCE value for a high weight to horsepower vehicle (such as a fully loaded 3S2 combination truck) is 2.2 on a multilane pavement in a flat rural area. The corresponding AMT value determined by comparison of axle numbers is 2.5, which is calculated by dividing the five axles of a 3S2 truck tractor semi-trailer by the two axles of a passenger car. For this reason, the AMT allocator is a reasonable surrogate for PCE-VMT in flat rural areas such as Kansas. However, the concept of passenger car equivalencies was developed as a measure of highway capacity, which seldom is a problem in Kansas. When capacity becomes a problem, the PCE-VMT and/or AMT allocators should be reconsidered.

PAVEMENT

Pavement construction types vary from new pavements placed on unpaved subgrades through overlays and other treatments of existing pavements. A minimum pavement thickness method adapted from the 1982 Federal study will be used for allocating pavement costs to various classes of vehicles. The pavement thickness for each of the pavement construction types is designed in accordance with standard design practices. The design thickness is the minimum necessary to resist the environment and to provide service for a minimal number of vehicles and an additional thickness required to provide service for additional vehicles.

The costs of the minimum pavement thickness for the basic road will be shared by all vehicles on the basis of relative use. Costs of additional width of the minimum pavement will be shared by wider vehicles requiring additional width of the minimum pavement on the basis of relative use of wider vehicles. Table 1 shows a 22-foot pavement width (two lanes @ 11 feet) for a basic service road and a 24-foot pavement width (two lanes @ 12 feet) for a full service road. All vehicles would share in the cost of minimum pavement in the amount of 22/24 or 91.67 percent on the basis of VMT by all vehicles. Wider vehicles, as listed in Table 4, would share the remaining 8.33 percent of the minimum pavement cost on the basis that the minimum pavement is non-weight related and is intended primarily to resist environment and to provide service to a minimal number of vehicles. The VMT allocator will assess a uniform charge per vehicle mile traveled by all vehicles.

The minimum pavement thicknesses used in this study will be six inches for new pavements and 3/4 inch for overlays and other treatments to existing pavements. The six inches minimum thickness is consistent with the AASHTO Interim Guide for Design of Pavement Structures (page 24), the 1982 Federal Highway Cost Allocation Study (page D-5), and with past and present KDOT practices. The 3/4 inch minimum pavement thickness for overlays and other treatments to existing pavements is consistent with Federal Highway Administration Notice (N 5040.19) Resurfacing, Restoration and Rehabilitation (3R) Work (page 2), and with past and present KDOT practices.

Costs of additional pavement thickness required to provide service to additional vehicles will be allocated in proportion to their contributions of Equivalent Single Axle Loadings (ESAL-miles) to the total traffic stream of ESAL-miles. All vehicles will share in the cost of the additional thickness of the width of a basic service pavement. Wider vehicles, as listed in Table 4, will share in the cost of the additional width of the additional thickness. A visual depiction of the allocation method is shown in Figure 1.

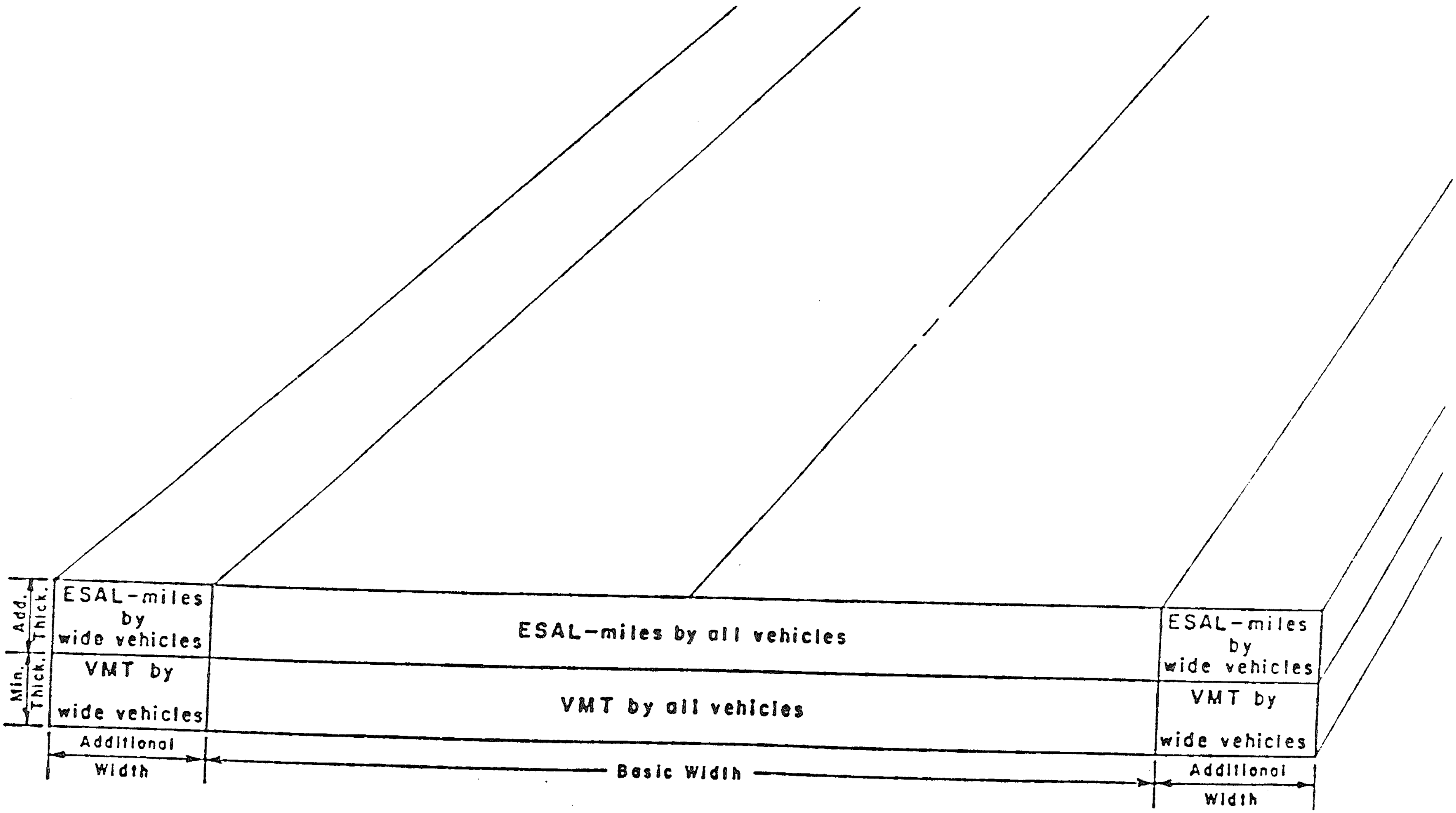
Eighteen thousand pound equivalent single axle loadings (ESAL) will be determined from equivalency factors developed from AASHTO Road Test Equations which are widely used for pavement design. Equivalency factors for rigid and flexible pavements with a thickness (D) of nine inches and a structural number (SN) of 4 are shown in Table 7, page 16. Appropriate equivalency factors from these tables for each axle will be combined using average axle loads from the Kansas truck surveys and from regional federal truck surveys for each vehicle class to obtain an average value for vehicles in that class. The ESAL value multiplied by vehicle miles traveled will yield ESAL-miles for each vehicle class.

The other pavement cost allocation technique considered was the incremental method used in the 1965 Federal Study. This method uses a design procedure whereby axle loads are divided into six increments. The axle loading value for each increment is rounded upward to the upper boundary of their increment interval with the heaviest increment (no upper limit) represented by an average axle loading. A series of pavement thicknesses are designed. The first thickness is designed for all axle loadings and is the design thickness of the pavement. A second thickness is designed for all axle loadings up to the upper boundary of the second heaviest axle loading increment. The cost of the difference in thickness is allocated equally to all axles above the upper boundary of the second heaviest axle loading increment; successive designs and cost allocations are repeated until all axle loading increments have had their respective costs allocated. This method was developed specifically to fund new pavements for the interstate system. Overlays and other treatments to existing pavements were not considered. The pavement incremental cost allocation technique was rejected because it unfairly assigns advantages of economy of scale and exponential increase in pavement strength with pavement thickness to heavier axle loadings. Economy of scale refers to the fact that an increase in thickness seldom requires a proportionate increase in construction operations. Exponential relationship of pavement strength with an increase in pavement thickness refers to the fact that a lesser additional pavement thickness is required for a given number of 18 kip equivalent single axle loadings for a thicker pavement than for a thinner pavement. To illustrate the exponential increase in pavement strength, a Phillips County (US 183) pavement was designed using the incremental design procedure. Table 6 compares axle loadings and required design thicknesses. Only five increments are shown because the over 20,000 pound increment combines with the 16,000 - 20,000 pound increment if the average maximum axle weight criterion from the 1965 Federal study is used.

TABLE 6

PAVEMENT THICKNESS BY INCREMENTAL DESIGN
PHILLIPS COUNTY (US-183)

AXLES RESPONSIBLE	PAVEMENT THICKNESS
All axles 3,000 pounds or less	6.8"
All axles over 3,000 pounds	9.7"
All axles over 7,000 pounds	12.3"
All axles over 12,000 pounds	13.5"
All axles over 16,000 pounds	14.5"



MINIMUM PAVEMENT ALLOCATION TECHNIQUE

Figure No. 1

TABLE 7

18,000 POUND AXLE EQUIVALENCE FACTORS

GROSS AXLE LOAD (LBS.)	FLEXIBLE PAVEMENT (SN=4, P=2.5) SINGLE AXLES	TANDEM AXLES	RIGID PAVEMENT (D=9, P=2.5) SINGLE AXLES	TANDEM AXLES
1,000	0.00003		0.00003	
2,000	.00022		.00020	
3,000	.00089		.00076	
4,000	.00260		.00214	
5,000	.00618		.00497	
6,000	.01279		.01013	
7,000	.0239		.0188	
8,000	.0412		.0324	
9,000	.0667		.0526	
10,000	.1023	0.00850	.0817	0.0126
11,000	.150	.01241	.1220	.0182
12,000	.212	.0176	.176	.0256
13,000	.291	.0243	.248	.0353
14,000	.388	.0329	.340	.0475
15,000	.506	.0436	.457	.0628
16,000	.645	.0567	.603	.0818
17,000	.809	.0726	.782	.1050
18,000	1.000	.0917	1.000	.133
19,000	1.22	.1143	1.26	.166
20,000	1.47	.141	1.57	.206
21,000	1.76	.171	1.93	.253
22,000	2.09	.207	2.34	.308
23,000	2.47	.247	2.82	.371
24,000	2.89	.292	3.36	.444
25,000	3.37	.344	3.98	.527
26,000	3.92	.401	4.67	.622
27,000	4.52	.464	5.43	.729
28,000	5.21	.534	6.29	.850
29,000	5.93	.611	7.24	.986
30,000	6.83	.695	8.28	1.137
31,000	7.79	.787	9.43	1.31
32,000	8.85	.887	10.70	1.49
33,000	10.03	.996	12.09	1.70
34,000	11.34	1.113	13.62	1.92
35,000	12.78	1.24	15.29	2.16
36,000	14.38	1.38	17.12	2.43
37,000	16.14	1.52	19.12	2.72
38,000	18.07	1.68	21.31	3.03
39,000	20.18	1.85	23.69	3.37
40,000	22.50	2.03	26.29	3.74

SHOULDERS

Shoulders are intended to provide an emergency driving surface, to provide a storage area for disabled vehicles, to provide lateral support for roadway pavements and to resist the environment. Essentially the function of a shoulder is much the same as a pavement for a basic service road. Shoulder thickness must be sufficient to resist the environment and to provide service to a minimal number of vehicles. Cost allocation, then, would also be much the same. Table 1 shows a total shoulder width of eight feet (two shoulders at four feet) for a basic service road and a total shoulder width of 16 feet (two shoulders at eight feet) for a full service roadway. The basic roadway shoulder width represents 50 percent of total shoulder cost and should be allocated using the same rationale used for basic pavement thickness. The remaining 50 percent shoulder costs represent costs required to provide service for wider vehicles as listed in Table 4. Shoulder costs will be allocated as follows:

1. All vehicles will be responsible for 50 percent of shoulder costs on the basis of VMT by all vehicles.

2. Wider vehicles, as listed in Table 4, will be responsible for 50 percent of shoulder costs on the basis of VMT by wider vehicles.

NEW BRIDGES

A new bridge is a structure constructed on a new alignment in accordance with accepted design procedures. The new bridge, as defined in this study, does not replace an existing structure. Bridges are designed and proportioned to withstand expected forces, including dead load, live load and wind load. Design of live load is accomplished by applying axle loadings of "standard trucks" or equivalent lane loadings. Generally speaking, only the heaviest vehicles have any measurable effect on the fatigue life of a bridge.

The incremental method of allocating costs of new bridges begins by designing the structure for full design loading. The first vehicle class, consisting of the heaviest vehicles, is then removed from consideration and the structure is designed a second time to withstand the reduced load. The cost differential between the two designs is calculated and assigned to the classes of vehicles removed. This process continues, with the second increment of cost, caused by removing the second class of vehicles, being assigned to the two classes of vehicles thus far removed. The method is repeated for successive vehicle groups until additional incremental removal does not successively affect the estimated cost of the bridge. Costs of this final bridge, known as the basic bridge (H5 design increment in this study), are then allocated to all vehicles. Table 9 lists bridge design increments and vehicle weight groups. Table 10 lists bridge design increments and vehicle classes responsible for a share of the cost of the design increments.

TABLE 8

BRIDGE DESIGN INCREMENTS
AND VEHICLE WEIGHT GROUPS

BRIDGE DESIGN INCREMENT	SINGLE UNIT VEHICLE WEIGHT GROUP (GVW POUNDS)	COMBINATION UNIT VEHICLE WEIGHT GROUP (GVW POUNDS)
H5	<10,000	<13,500
H10	10,000 to 19,999	13,500 to 26,999
H15	20,000 to 29,999	27,000 to 40,499
HS15	30,000 to 39,999	40,500 to 53,999
HS20	>40,000	>54,000

TABLE 9

BRIDGE DESIGN INCREMENTS
AND VEHICLE CLASSES RESPONSIBLE FOR COSTS

BRIDGE DESIGN INCREMENT	VEHICLE CLASSES RESPONSIBLE FOR COSTS
H5	All vehicles
H10	All buses All single unit trucks - 6 tired All single unit trucks - 3 axles All combination unit trucks
H15	Single unit trucks - 6 tired >19,500 GVW Single unit trucks - 3 axles >26,000 GVW Combination unit trucks - 3 axles >26,000 GVW All remaining combination unit trucks
HS15	Single unit trucks - 6 tired >26,000 GVW Single unit trucks - 3 axles >33,000 GVW Combination unit trucks - 3 axles >26,000 GVW All remaining combination unit trucks
HS20	Single unit trucks - 3 axles >40,000 GVW Combination unit trucks - 3 axles >26,000 GVW Combination unit trucks - 2S2 >60,000 GVW Combination unit trucks - 4 axles >60,000 GVW All remaining combination unit trucks

The incremental method has the disadvantage of allocating a disproportionate share to lower weight classes of vehicles because of the non-linear relationship between additional load capacity and cost of providing additional load capacity. However, it is the best technique available at this time. Table 10 illustrates the non-linear relationship using data developed for the FHCAS on Kansas bridges built in 1980 and 1981. The effects of the non-linear relationship between load capacity and cost can be reduced although not eliminated by using an axle miles traveled (AMT) cost allocator for allocating the costs of the basic (H5 design increment) bridge. The AMT allocator will shift costs to vehicles with more axles (usually the heavier vehicles) which gain advantage through the non-linear relationship of load capacity and cost.

Table 1 shows a bridge width of 28 feet for a basic service roadway (minor collector) and 40 feet for a full service roadway (principal arterial). Bridge costs do not vary as linearly with width as does pavement. A linear regression of bridge costs and widths performed on 164 structures let in Kansas during calendar years 1978 - 1982 determined that a width decrease from 40 feet to 28 feet (30.00 percent) resulted in a 33.81 percent decrease in bridge costs. The increased cost due to increased width is the responsibility of wider vehicles as listed in Table 4.

TABLE 10

BRIDGE DESIGN AND COST INCREMENTS

DESIGN INCREMENT	WIDTH COST INCREMENTS (PERCENT)	WEIGHT COST INCREMENTS (PERCENT)	CUMULATIVE COST INCREMENTS (PERCENT)
H5 (Basic Width)			52.31
H5 (Full Width)	33.81		86.12
H10		2.35	88.47
H15		3.36	91.83
HS15		3.51	95.34
HS20		4.66	100.00
Totals	33.81	13.88	

The costs of a new bridge will be allocated by width and by weight. The allocation procedure will be as follows:

1. All vehicles will be responsible for 52.31 percent of bridge costs, which represent the cost of a basic service (28-foot width) bridge, on the basis of AMT.

2. Wider vehicles as listed in Table 4 will be responsible for 33.81 percent of bridge costs on the basis of VMT.

3. Heavier vehicles will be responsible for 13.88 percent of bridge costs on the basis of VMT in specific bridge design increments as listed in Table 9. The 13.88 percent is further divided by the bridge weight cost increments shown in Table 10.

REPLACEMENT BRIDGES

A replacement bridge is a structure built specifically to replace an existing bridge which is structurally deficient and/or functionally obsolete. Replacement bridge costs will be allocated by a special incremental technique. The amount of deficiency in load-carrying capacity is considered influential when deciding to replace a bridge. Costs to be attributed to restoring load-carrying capacity can be determined by the relative importance of load-carrying capacity in the replacement decision. Allocation of replacement bridge costs will be performed as follows:

1. The proportional loss of bridge sufficiency due to deficient load carrying capacity will be allocated by VMT to the vehicle classes heavier than the load carrying capacity.

2. Remaining costs are incrementally allocated to all vehicle groups in the same manner as new bridges.

An argument can be made that vehicles weighing more than the weight capacity of an existing bridge should pay the entire cost of the replacement bridge. This argument is consistent with a cost occasioned approach, whereby vehicle classes responsible for costs are allocated those costs. This argument overlooks two essential considerations:

1. Rarely is restricted load-carrying capacity the sole reason for replacing a bridge.

2. Even when it is the sole reason, clear benefits are bestowed on vehicles weighing less than the load-carrying capacity.

Benefits, at the least, would include an extended service life available from the replacement bridge. For these reasons, the weight capacity technique was rejected. The incremental technique, described under the section on new bridges, was also considered as a method for allocating the entire costs of replacement bridges. However, it was not adopted because it does not recognize all possible reasons for replacement of a bridge. The existing bridge may be a satisfactory bridge in terms of width or condition, but not capable of carrying the weight of heavier vehicles. Therefore, under the incremental technique, lighter vehicles are responsible for a portion of the costs which are allocated for the bridge but are not required by the lighter vehicles. This would not be consistent with the cost occasioned approach.

BRIDGE REPAIR AND REHABILITATION

Bridge repairs consist of contract work performed on existing structures for the purpose of extending service life or protecting original investment. Bridge rehabilitations consist of contract work performed on existing structures for purposes of correcting structural deficiencies, slowing physical deteriorations, or alleviating functional obsolescence.

Bridge repair and rehabilitation costs will be allocated by the axle miles traveled (AMT) allocator. Wear on a bridge is a function of both traffic volume and weight. The AMT allocator measures both traffic volume and weight in that vehicles with additional axles are usually heavier vehicles.

Cost allocators of VMT and ton miles traveled (TMT) were also considered. VMT was not selected because it measures only the traffic volume portion of impacts caused by traffic volume and weight. TMT was seriously considered as an allocator for bridge repairs and rehabilitation, because it is a measure of traffic volume and weight. However, it was rejected because it overemphasizes the weight factor.

MISCELLANEOUS CONSTRUCTION

Other construction projects will be allocated under a miscellaneous category. These projects include, but are not limited to, such things as signing, marking, lighting, rest areas, landscaping, and fencing. The majority of miscellaneous construction projects are intended for driver observations in providing guidance, roadside comfort, safety, and enhancement of roadside aesthetics. Costs of miscellaneous construction activities will be allocated by the VMT allocator because numbers of driver observations are proportional to vehicle miles traveled.

MAINTENANCE

Maintenance activities performed by state forces consist of three categories, OVERHEAD COSTS, COMMON COSTS and ATTRIBUTABLE COSTS. The overhead cost category is either not affected or only marginally by changes in vehicle travel and include activities such as training, meetings, leave, administration, equipment, building, and land maintenance. The remaining two categories, common costs and attributable costs, are functions of vehicle use but at a different level. Common cost activities are functions of vehicle use in providing guidance to drivers, enhancement of roadside aesthetics, and providing driver/passenger comfort and safety. Common costs include activities such as mowing, roadside repairs, traffic control, and motorist services and are shared by all vehicles in proportion to their use of the system. The class of vehicle has little, if any, effect on level of service of common cost activities. For this reason, the cost allocator for common cost maintenance activities will be VMT. Attributable cost activities are caused or aggravated by physical effects of vehicles interacting with the roadway. Attributable cost activities include items such as pavement, shoulder, and bridge repairs. Vehicle weight, width, axle loadings, and use have significant effect on level of service of attributable cost activities. Vehicle weights and axle loadings affect pavements, shoulders, and bridges. Vehicle width affects pavements and shoulders and has a major effect at the interface between pavement and shoulders. For these reasons, a cost allocator sensitive to weight, widths and use is required. The ton miles traveled (TMT) allocator was selected because heavier vehicles are also generally wider vehicles. Maintenance activities will be allocated by the following procedure:

1. All vehicles will be responsible for common cost activities on the basis of VMT.

2. All vehicles will be responsible for attributable cost activities on the basis of TMT.

3. Overhead cost activities will be prorated to common and attributable costs.

Other cost allocators considered for attributable cost activities included the judgmental approach, axle miles traveled (AMT), and equivalent single axle loadings (ESAL). In the judgmental allocation technique, a panel of experts is polled to determine the need in its opinion for maintenance created by various classes of vehicles. Although the judgmental technique was not adopted, the technique is conceptually acceptable inasmuch as physical effects of vehicles interacting with the roadway are recognized, but are often difficult to quantify. Axle miles traveled (AMT) was also considered as an allocator for attributable cost maintenance activities. The reason for consideration was that vehicles with more than two axles will wear the roadway more than those with only two axles. As examples, polishing of pavement surface, wearing of pavement markings, and progressive growth of potholes are all functions of axle passages and impacts. However, axle miles traveled does not sufficiently recognize the weight factor. The ESAL-miles allocator was also considered but was not adopted. Each vehicle has an equivalent single axle load which is a function of axle loadings and spacings. The ESAL-miles allocator would be conceptually acceptable for traffic related activities. It recognizes that axle loadings contribute to the need for maintenance. However, the weight factor is over-emphasized and would more equitably be measured by the TMT allocator. Table 11 lists maintenance work categories and classifies them by overhead cost, common cost and attributable cost activities.

TABLE 11

MAINTENANCE WORK CATEGORIES

OVERHEAD COST ACTIVITIES	COMMON COST ACTIVITIES	ATTRIBUTABLE COST ACTIVITIES
Training	Drainage	Pavements
Meetings	Roadside and Landscape	Shoulders
Leave	Spraying	Bridges
Administration	Signs and Markers	Striping and Marking
Equipment Maintenance	Snow and Ice	Traffic Control Services
Building Maintenance	Lighting	Motor Carrier Stations
Land Maintenance	Rest Areas	
Longitudinal Barriers	Fencing	
Emergency Operations	Litter Pickup	
Detours	Motorist Service	
	Park Roads	

ADMINISTRATION

Every organization has an administrative structure. The costs of this structure are required by virtue of the legislatively stipulated need for a Department of Transportation. Examples of administrative functions include the office of the Secretary of Transportation, data processing, legal, budget, planning and personnel, as well as non-project related costs from the Division of Engineering and Design and the Division of Operations. These administrative costs are overhead costs inasmuch as they are either not affected or only marginally by changes in vehicle travel. The overhead costs will be prorated to the various classes of vehicles in the same proportions as the allocated costs of construction, maintenance, division of motor vehicle expenditures, and freeway debt service.

FREEWAY DEBT SERVICE

A significant area of expenditure in the Kansas highway program is for projects in the freeway program. The freeway program is funded through issuance of revenue bonds used for construction of roadways in statutorily defined corridors. Bonds are being retired from designated user revenues. Either construction projects or debt service may be treated as expenditures but not both. To include both would be to expend the same monies twice. Kansas budgeting and accounting systems assign debt service as an expenditure. To be consistent, this study will do the same. Costs of freeway debt service will be allocated by a time-specific cost allocation study. The cost allocation study will be based upon the same program years as those used in the parent study. The freeway study and the parent study will be parallel studies with a commonality of data collection and allocation techniques. However, only design, right-of-way, and construction costs will be considered in this study.

A separate cost allocation study of the entire freeway program was rejected because of time period sequence, masses of data required, and inconsistency with other portions of the Kansas Highway Cost Allocation Study.

STATUTORY DISBURSEMENTS

A significant amount of user fees are transferred to other governmental entities as mandated by state law and other legislative direction. The procedure for allocating statutory disbursement will be performed as follows:

1. The costs of the Motor Carrier Inspection Bureau will be the responsibility of vehicles subject to its purview on the basis of VMT.

2. The costs of Driver Licensing and Vehicle Registration activities will be the responsibility of all vehicles on the basis of the number (N) of registered vehicles.

CONCLUSION

As stated in the introduction, the objective of this document is to provide an overview of technical considerations and cost allocators proposed for the Kansas Highway Cost Allocation Study. The multi-disciplinary professionals authoring the study believe that the objective has been met. The results of the study provide a direction considered fair to all with no special advantage to any.

end of chapter 1 BLANK ON PURPOSE

REVIEW PROCESS
SELECTION OF COST ALLOCATION TECHNIQUES

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL REVIEW ADJUSTMENTS
	<u>Efficiency vs. Equity</u> On the basis of reviews and comments, a conceptual discussion of the efficiency vs. equity issue was added. Equity will be the basis of the study.	No Adjustments
<u>Cost Categories</u> The task force recommended the use of two cost categories, common costs and attributable costs. Common costs would be the costs of a basic service roadway. Attributable costs would be the additional costs required for a full service roadway.	No Adjustments	The task force concurs with commenters and now recommends the following adjustments. Three cost categories will be used: overhead, common and attributable costs. Overhead costs would be the costs not affected or only marginally by an increase in travel. Common costs would be the travel related costs of a basic service roadway. Attributable costs would be the additional costs required for a full service roadway.
<u>Right-of-Way, Grading and Drainage</u> The task force recommended that costs of right-of-way, grading, and drainage be allocated using the ratio of pavement lane widths of basic and full service roads. This allocates 91.67% of the costs to all vehicles with the remaining 8.33% allocated to wider vehicles.	The task force concurred with commenters who advised that costs of right-of-way, grading and drainage should be allocated using the ratio of roadway widths of basic and full service roads. This allocates 75% of the costs to all vehicles with the remaining 25% allocated to wider vehicles.	The task force concurs with the commenter who advised that a 25% allocation to wider vehicles is excessive The task force now recommends that costs of right-of-way, grading, and drainage be allocated by the ratio of typical embankment excavation roadway designs of basic and full service roads. This allocated 93% of the costs to all vehicles with the remaining 7% allocated to wider vehicles.

REVIEW PROCESS (CONTINUED)
SELECTION OF COST ALLOCATION TECHNIQUES

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL REVIEW ADJUSTMENTS
New Pavement The task force recommended that the costs of the basic width of the minimum pavement thickness be allocated by the axle miles traveled allocator (AMT).	The task force concurred with commenters who advised that the costs of the basic width of the minimum pavement thickness should be allocated by the vehicle miles traveled allocator (VMT).	No Adjustments
The task force recommended that the costs of additional pavement thickness and the total thickness of additional width be allocated by ESAL-miles.	The task force concurred with commenters who advised: 1) Additional width of minimum pavement thickness be allocated to wider vehicles on the basis of VMT. 2) Basic width of additional pavement thickness be allocated to all vehicles on the basis of ESAL-miles. 3) Additional width of additional pavement thickness be allocated to wider vehicles on the basis of ESAL-miles.	No Adjustments
Rehabilitated Pavement The task force recommended that the costs of rehabilitated pavement be allocated by the Brent Rauhut consumption models used in the 1982 Federal Cost Allocation Study.	The task force concurred with commenter who stated that data required for consumption models is not available. The task force now recommends that the Minimum Pavement Method be used for rehabilitated pavement as well as for new pavement.	No Adjustment

REVIEW PROCESS (CONTINUED)
SELECTION OF COST ALLOCATION TECHNIQUES

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL REVIEW ADJUSTMENTS
<u>Shoulders</u> The task force recommended that shoulder costs and pavement costs be grouped together.	On the basis of reviews and comments, shoulder costs will be separated from pavement costs and allocated as a separate item. The task force now recommends that shoulder costs be allocated using the ratio of shoulder widths of basic and full service roads. This allocates 50% of the costs to all vehicles with the remaining 50% allocated to wider vehicles.	No Adjustment
<u>New Bridges</u> The task force recommended that the costs of the basic bridge be allocated by the axle miles traveled (AMT) allocator.	The task force concurred with commenters who stated that additional bridge width be a width sensitive allocator. The task force now recommends that the cost of additional bridge width be allocated on the basis of vehicle miles traveled (VMT) by wider vehicles.	No Adjustment

REVIEW PROCESS (CONTINUED)
SELECTION OF COST ALLOCATION TECHNIQUES

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL REVIEW ADJUSTMENTS
<u>Maintenance</u> The task force recommended that use of two cost categories: Traffic Remote and Traffic Related costs. Traffic Remote costs are costs of providing guidance to drivers, enhancement of roadside aesthetics, and providing driver/passenger comfort and safety. Traffic Related costs are caused or aggravated by vehicle use.	The task force concurred with commenters who urged the use of common and attributable cost categories to replace Traffic Remote and Traffic Related cost activities respectively.	The task force concurs with commenters and now recommends the following adjustment. Three cost categories will be used: overhead, common, and attributable costs. Overhead costs would be costs such as leave and training, not affected by travel. Common costs would be costs such as driver guidance and roadside aesthetics, only marginally affected by travel. Attributable costs would be costs such as pavement and shoulder repairs caused or aggravated by traffic.
The task force recommended that Traffic Related costs (renamed in later drafts to Attributable costs) be allocated by the axle miles traveled (AMT) cost allocator.	The task force concurred with commenters who stated that the AMT allocator does not sufficiently recognize vehicle weight. The task force now recommends that Attributable costs be allocated by the ton miles traveled (TMT) cost allocator.	No Adjustments
<u>Administration and Management</u> The task force recommended that costs of administration be allocated on the basis of the vehicle miles traveled (VMT) cost allocator.	No Adjustments.	<u>First External (Review)</u> The task force concurs with commenters who advised that costs of administration not directly related to construction and maintenance be identified as overhead costs and prorated to the various classes on the basis of a percentage markup.

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL REVIEW ADJUSTMENTS
		Second External (Review) Although the task force did not concur with an external suggestion that the costs of administration not directly related to construction and maintenance be allocated on the basis of vehicle miles traveled (VMT) cost allocator, the task force recognized that ALL allocated costs should be used to determine the prorated shares. The task force now recommends that the costs of administration not directly related to construction, maintenance, division of motor vehicles, and freeway debt service, be prorated to the various classes of vehicles in the same proportions as the allocated costs of construction, maintenance, division of motor vehicles, and freeway debt service.
Statutory Disbursements The task force recommended that costs of statutory disbursement (with the exception of the Motor Carrier Inspection Bureau) be assigned on the basis of a percentage markup to all other costs allocated to various vehicle classes.	The task force concurred with commenter who stated that costs of Driver License Control and Vehicle Registration be allocated by the number of vehicles (N) cost allocator.	No Adjustment

end of REVIEW PROCESS blank on purpose

CHAPTER 2
ALLOCATION OF EXPENDITURES

Table 5, "Kansas Cost Allocators," in the Chapter entitled "Selection of Cost Allocation Techniques," lists the allocators which will be used in this study. These expenditures to be allocated are in four general areas: 1) Construction, 2) Maintenance, 3) Non-Construction or Maintenance, and 4) Freeway Debt Service.

CONSTRUCTION EXPENDITURES

The published 1985-1989 construction program was used to determine construction expenditures for the four year study period of 1985-1988. The construction expenditures were disaggregated into the following categories:

Right-of-Way, Grading and Drainage
New Flexible Pavements
New Rigid Pavements
Rehabilitated Pavements
Shoulders
New Bridges
Replacement Bridges
Bridge Repairs/Rehabilitation
Miscellaneous Construction

The disaggregated construction expenditures were then allocated using the allocators developed in the chapter entitled "Selection of Cost Allocation Techniques." The allocated expenditures were then aggregated into the following categories:

Right-of-Way, Grading and Drainage
Pavements
Shoulders
Bridges
Miscellaneous Construction

Table 2, "TOTAL KANSAS FUNDS RESPONSIBILITY-CONSTRUCTION-ALL VEHICLE TYPES" shows the allocated construction expenditures by aggregated construction categories by the 38 vehicle types used in the study. Table 3 is similar to Table 2 but shows the allocated expenditures by various combinations of vehicle types. Table 16, "VEHICLE TYPES USED FOR ANALYTICAL AND REPORTING PURPOSES," references various combinations of vehicle types to the 38 vehicle types used to allocate highway costs. The total Kansas funds allocated for the four year study period is $262,834,000. Passenger vehicles are allocated 50.08% and trucks 49.92% of the construction expenditures.

MAINTENANCE EXPENDITURES

Maintenance expenditures were developed jointly by the Bureau of Construction and Maintenance and the Bureau of Management and Budget. The Bureau of Construction and Maintenance developed cost figures for activities to be allocated as overhead, common costs, and attributable costs. A listing of these activities is shown in Table 1, "LISTING OF MAINTENANCE EXPENDITURES."

TABLE 1

LISTING OF MAINTENANCE EXPENDITURES

OVERHEAD COST ACTIVITIES	COMMON COST ACTIVITIES	ATTRIBUTABLE COST ACTIVITIES
Training	Detours	Pavements
Meetings	Drainage	Shoulders
Leave	Emergency Operations	Bridges
Administration	Roadside & Landscape	Striping & Marking
Equipment Maintenance	Spraying	Traffic Control Service
Building Maintenance	Signs & Markings	Motor Carrier Stations
Land Maintenance	Snow & Ice	
	Lighting	
	Longitudinal Barriers	
	Rest Areas	
	Fencing	
	Litter Pickup	
	Motorist Services	
	Park Roads	

The activity percentages of the expenditures developed by the Bureau of Construction and Maintenance are as follows:

Overhead	19.241%
Common	38.766%
Attributable	41.993%
	100.000%

The overhead percentage was then prorated to Common and Attributable Costs so that the Maintenance budget was allocated with 48.11% to Common Costs and 51.89% to Attributable Costs.

The Bureau of Management and Budget estimated the Maintenance Expenditures for the four year study period (FY 1985 through FY 1988) to be $299,141,000. The Maintenance Expenditures were then allocated using the allocators developed in the chapter entitled "Selection of Cost Allocation Techniques." The 48.11% Common Costs was allocated to all vehicles on the basis of Vehicle Miles Traveled (VMT). The 51.89% Attributable Costs was allocated to all vehicles on the basis of Ton Miles Traveled (TMT).

Table 4, "TOTAL KANSAS FUNDS RESPONSIBILITY - MAINTENANCE - ALL VEHICLE TYPES" shows the allocated maintenance expenditures by Common, Attributable, and Total costs, by the 38 vehicle types used in the study. Table 5 is similar to Table 4 but shows the allocated expenditures by various combinations of vehicle types. Passenger vehicles are allocated 67.20% and trucks 32.80% of the $299,141,000 Maintenance Expenditure.

DIVISION OF MOTOR VEHICLE EXPENDITURES

Division of Motor Vehicle Expenditures include the costs of the Motor Carrier Inspection Bureau, and the Driver Licensing and Control and Vehicle Registration functions of the Bureau of Vehicles in the Department of Revenue. The costs of the Motor Carrier Inspection Bureau were allocated to the vehicles inspected by the Bureau on the basis of vehicle miles traveled (VMT) by those vehicles. The costs of Drivers Licensing and Control and Vehicle Registrations were allocated to each vehicle.

Table 6, "TOTAL KANSAS FUNDS RESPONSIBILITY - DIVISION OF MOTOR VEHICLES - ALL VEHICLE TYPES" shows the allocated Division of Motor Vehicle Expenditures by specific category and by the 38 vehicle types used in the study. Table 7 is similar to Table 6 but shows the allocated expenditures by various combinations of vehicle types. Passenger vehicles are allocated 60.21% and trucks 39.79% of the $55,233,000 Division of Motor Vehicle Expenditures.

TOTAL KANSAS FREEWAY DEBT SERVICE RESPONSIBILITY

The Kansas Department of Transportation has a freeway debt service requirement which began in 1973 and is scheduled for completion in 2003. The freeway debt service is allocated by a separate cost allocation study limited to bond financed projects during the four year study. During the study period, $47,734,000 bond construction funds will be used. During the same period $84,591,395 will be required for debt service.

Table 9, "TOTAL KANSAS FREEWAY DEBT SERVICE RESPONSIBILITY - ALL VEHICLE TYPES" shows the amounts by construction types by the 38 vehicle classes used in the study. The construction types are then aggregated into total Construction Costs and percentages. The percentages are then used to disaggregate the $84,591,395 debt service requirement by the 38 vehicle classes used in the study.

Table 10 is similar to Table 9 but shows the allocated debt service requirement by various combinations of vehicle types. Passenger vehicles are allocated 62.93% and trucks 37.07% of the $84,591,395 debt requirement during the four year study period.

TOTAL KANSAS FUNDS RESPONSIBILITY - ALL COSTS

Table 10, "TOTAL KANSAS FUNDS RESPONSIBILITY - ALL COSTS - ALL VEHICLE TYPES," summarizes Tables 2, 4, 6, and 8 and lists costs of Construction, Maintenance, Division of Motor Vehicles, and Freeway Debt Service. These costs were summed and are shown as SUBTOTAL costs. The SUBTOTAL costs were converted to percent by vehicle types. These percents are used to prorate Administration Costs which include non-project related costs of Engineering, Design, and Operations, administrative functions of the Kansas Department of Transportation, and net transfers. The TOTAL costs column shows the allocated TOTAL costs by vehicle types. Table 11 is similar to Table 10 but shows the allocated TOTAL costs by various combinations of vehicle types. Passenger cars are allocated 59.72% and trucks 40.28% of the $286,858,000 Administration Costs of the four year study period.

ALLOCATED COST PER VEHICLE PER YEAR AND PER VMT

A primary purpose of a cost allocation study is to ascertain the costs for which each vehicle is responsible. Table 12, "ALLOCATED COST PER VEHICLE PER YEAR AND PER VMT - ALL VEHICLE TYPES" shows the Average Annual Cost Per Vehicle and Average Cost Per Vehicle Mile Traveled for the 38 vehicle classes used in the study. Table 12 clearly shows an increase in cost as the registered gross vehicle weight increases. The average annual cost ranges from $22.45 for a motorcycle to $4,208.48 for a 6 axle tractor trailer registered for more than 75,000 pounds. A similar comparison of the average cost per vehicle miles traveled also shows an increase in cost with an increase in registered gross vehicle weight. The average cost per vehicle mile traveled ranges from $0.008 for both the standard and small autos to $0.063 for a 6 axle tractor trailer registered for more than 75,000 pounds.

Table 13 is similar to Table 12 but aggregates the Average Annual Cost Per Vehicle and Average Cost Per Vehicle Mile Traveled for various combinations of vehicle types. The aggregation shifts costs from heavier vehicles to lighter vehicles within the combined class. The cost shift clearly demonstrates the need to use as many vehicle classes as is practicable.

The allocated costs developed will be compared with attributed revenue so that a relative cost/revenue ratio can be developed.

TABLE 2

TOTAL KANSAS FUNDS RESPONSIBILITY - CONSTRUCTION
ALL VEHICLE TYPES

VEHICLE TYPE	ALLOCATED TOTAL ROWGRDR COSTS ($000)	ALLOCATED TOTAL PAVEMENT COSTS ($000)	ALLOCATED TOTAL SHOULDER COSTS ($000)	ALLOCATED TOTAL BRIDGE COSTS ($000)	ALLOCATED TOTAL MISC. CONST. COSTS ($000)	ALLOCATED 1985-88 CONST. COSTS ($000)	ALLOCATED 1985-88 CONST COSTS PERCENT
1 Standard Auto	$ 10,689	$ 25,414	$ 1,007	$ 17,465	$ 2,010	$ 56,586	21.53%
2 Small Auto	5,840	13,721	550	9,541	1,098	30,750	11.70
3 Motorcycle	255	599	24	417	48	1,343	0.51
4 Intercity Bus	26	265	14	169	3	477	0.18
5 Transit Bus	12	92	7	80	1	193	0.07
6 School Bus	127	1,739	69	754	15	2,704	1.03
7 SU-4T <6	0	0	0	0	0	0	0.00
8 SU-4T 6-10	0	0	0	0	0	0	0.00
9 SU-4T >10	6,899	19,454	650	11,272	1,297	39,571	15.06
10 SU-6T <19.5	521	1,673	284	3,092	60	5,629	2.14
11 SU-6T 19.5-26	626	4,069	341	4,072	72	9,180	3.49
12 SU-6T >26	212	1,661	116	1,541	24	3,555	1.35
13 SU-3AX <26	19	159	10	121	2	311	0.12
14 SU-3AX 26-33	65	990	36	457	7	1,555	0.59
15 SU-3AX 33-40	55	707	30	427	6	1,226	0.47
16 SU-3AX 40-50	356	5,465	194	3,178	41	9,233	3.51
17 SU-3AX >50	0	0	0	0	0	0	0.00
18 CU-3AX <26	0	0	0	0	0	0	0.00
19 CU-3AX 26-50	192	1,754	105	1,717	22	3,789	1.44
20 CU-3AX >50	6	55	3	53	1	118	0.04
21 CU-2S2 <50	52	299	28	426	6	811	0.31
22 CU-2S2 50-60	286	3,744	156	2,362	33	6,581	2.50
23 CU-2S2 >60	7	111	4	65	1	188	0.07
24 CU-4AX <50	5	31	3	39	1	78	0.03
25 CU-4AX 50-60	27	441	14	219	3	704	0.27
26 CU-4AX >60	1	8	0	6	0	16	0.01
27 CU-3S2 <50	2	22	1	17	0	42	0.20
28 CU-3S2 50-70	99	2,037	54	988	11	3,191	1.21
29 CU-3S2 70-75	458	9,692	250	4,551	53	15,004	5.71
30 CU-3S2 >75	1,830	41,270	997	18,178	210	62,485	23.77
31 CU-5AX <50	0	1	0	1	0	2	0.00
32 CU-5AX 50-70	6	35	3	58	1	103	0.04
33 CU-5AX 70-75	27	607	15	268	3	920	0.35
34 CU-5AX >75	108	2,593	59	1,072	12	3,843	1.46
35 CU-6AX+ <50	0	1	0	0	0	1	0.00
36 CU-6AX+ 50-70	3	37	1	28	0	69	0.03
37 CU-6AX+ 70-75	14	391	7	141	2	554	0.21
38 CU-6AX+ >75	53	1,385	29	551	6	2,023	0.77
Totals	$ 28,877	$140,522	$ 5,061	$ 83,324	$ 5,050	$262,834	100.00%

TABLE 3

TOTAL KANSAS FUNDS RESPONSIBILITY - CONSTRUCTION
COMBINED VEHICLE TYPES

VEHICLE TYPE	ALLOCATED TOTAL ROWGRDR COSTS ($000)	ALLOCATED TOTAL PAVEMENT COSTS ($000)	ALLOCATED TOTAL SHOULDER COSTS ($000)	ALLOCATED TOTAL BRIDGE COSTS ($000)	ALLOCATED TOTAL MISC. CONST. COSTS ($000)	ALLOCATED 1985-88 CONST. COSTS ($000)	ALLOCATED 1985-88 CONST COSTS PERCENT
1 Standard Auto	$ 10,689	$ 25,414	$ 1,007	$ 17,465	$ 2,010	$ 56,586	21.53%
2 Small Auto	5,840	13,721	550	9,541	1,098	30,750	11.70
3 Motorcycle	255	599	24	417	48	1,343	0.51
4 Intercity Bus	26	265	14	169	3	477	0.18
5 Other Bus	140	1,831	76	834	16	2,897	1.10
6 Pickup/Van	6,899	19,454	650	11,272	1,297	39,572	15.06
7 SU Truck <26	1,166	5,901	635	7,284	134	15,120	5.75
8 SU Truck >26	689	8,823	375	5,603	79	15,569	5.92
9 CU Truck <50	250	2,106	136	2,200	29	4,721	1.80
10 CU Truck 50-70	434	6,469	237	3,779	50	10,969	4.17
11 CU Truck 70-75	499	10,690	272	4,960	57	16,478	6.27
12 CU Truck >75	1,991	45,248	1,084	19,800	229	68,352	26.01
Totals	$ 28,877	$140,521	$ 5,061	$ 83,324	$ 5,050	$262,833	100.00%
1 Autos	$ 16,529	$ 39,135	$ 1,557	$ 27,006	$ 3,108	$ 87,336	33.23%
2 Motorcycles	255	599	24	417	48	1,343	0.51
3 Buses	166	2,096	90	1,003	19	3,374	1.28
4 Pickups/Vans	6,899	19,454	650	11,272	1,297	39,571	15.06
5 SU Trucks	1,854	14,724	1,010	12,887	213	30,689	11.68
6 CU Trucks	3,174	64,513	1,729	30,740	365	100,521	38.24
Totals	$ 28,877	$140,521	$ 5,061	$ 83,324	$ 5,050	$262,833	100.00%
1 Passengers	$ 23,848	$ 61,284	$ 2,322	$ 39,697	$ 4,472	$131,624	50.08%
2 Trucks	5,029	79,237	2,739	43,627	578	131,209	49.92
Totals	$ 28,877	$140,521	$ 5,061	$ 83,324	$ 5,050	$262,833	100.00%

TABLE 4

TOTAL KANSAS FUNDS RESPONSIBILITY - MAINTENANCE
ALL VEHICLE TYPES

VEHICLE TYPE	ALLOCATED COMMON MAINTE-NANCE COSTS ($000)	ALLOCATED COMMON MAINTE-NANCE COSTS PERCENT	ALLOCATED ATTRIBUT-ABLE MAINTE-NANCE COSTS ($000)	ALLOCATED ATTRIBUT-ABLE MAINTE-NANCE COSTS PERCENT	ALLOCATED TOTAL MAINTE-NANCE COSTS ($000)	ALLOCATED TOTAL MAINTE-NANCE COSTS PERCENT
1 Standard Auto	$ 57,283	39.80%	$ 28,830	18.57%	$ 86,113	28.79%
2 Small Auto	31,293	21.74	10,125	6.52	41,418	13.85
3 Motorcycle	1,367	0.95	164	0.11	1,531	0.51
4 Intercity Bus	86	0.06	165	0.11	250	0.08
5 Transit Bus	41	0.03	78	0.05	119	0.04
6 School Bus	416	0.29	798	0.51	1,214	0.41
7 SU-4T <6	0	0.00	0	0.00	0	0.00
8 SU-4T 6-10	0	0.00	0	0.00	0	0.00
9 SU-4T >10	36,969	25.69	33,402	21.52	70,371	23.52
10 SU-6T <19.5	1,706	1.19	2,519	1.62	4,225	1.41
11 SU-6T 19.5-26	2,049	1.42	4,080	2.63	6,129	2.05
12 SU-6T >26	696	0.48	1,784	1.15	2,479	0.83
13 SU-3AX <26	61	0.04	122	0.08	184	0.06
14 SU-3AX 26-33	214	0.15	548	0.35	762	0.25
15 SU-3AX 33-40	180	0.13	569	0.37	749	0.25
16 SU-3AX 40-50	1,164	0.81	4,688	3.02	5,852	1.96
17 SU-3AX >50	0	0.00	0	0.00	0	0.00
18 CU-3AX <26	0	0.00	0	0.00	0	0.00
19 CU-3AX 26-50	629	0.44	2,533	1.63	3,162	1.06
20 CU-3AX >50	19	0.01	96	0.06	115	0.04
21 CU-2S2 <50	169	0.12	534	0.34	703	0.23
22 CU-2S2 50-60	937	0.65	4,628	2.98	5,566	1.86
23 CU2S2 >60	23	0.02	133	3.09	156	0.05
24 CU-4AX <50	16	0.01	49	0.03	65	0.02
25 CU-4AX 50-60	87	0.06	429	0.28	516	0.17
26 CU-4AX >60	2	0.00	13	0.01	15	0.00
27 CU-3S2 <50	5	0.00	17	0.01	23	0.01
28 CU-3S2 50-70	326	0.23	1,917	1.23	2,242	0.75
29 CU-3S2 70-75	1,500	1.04	9,562	6.16	11,062	3.70
30 CU-3S2 >75	5,991	4.16	42,684	27.50	48,675	16.27
31 CU-5AX <50	0	0.00	1	0.00	1	0.00
32 CU-5AX 50-70	19	0.01	112	0.07	132	0.04
33 CU-5AX 70-75	88	0.06	563	0.36	652	0.22
34 CU-5AX >75	353	0.25	2,516	1.62	2,869	0.96
35 CU-6AX+ <50	0	0.00	0	0.00	1	0.00
36 CU-6AX+ 50-70	9	0.01	52	0.03	60	0.02
37 CU-6AX+ 70-75	44	0.03	282	0.18	326	0.11
38 CU-6AX+ >75	73	0.12	1,231	0.79	1,404	0.47
Totals	$143,917	100.00%	$155,224	100.00%	$299,141	100.00%

TABLE 5

TOTAL KANSAS FUNDS RESPONSIBILITY - MAINTENANCE
COMBINED VEHICLE TYPES

VEHICLE TYPE	ALLOCATED COMMON MAINTENANCE COSTS ($000)	ALLOCATED COMMON MAINTENANCE COSTS PERCENT	ALLOCATED ATTRIBUTABLE MAINTENANCE COSTS ($000)	ALLOCATED ATTRIBUTABLE MAINTENANCE COSTS PERCENT	ALLOCATED TOTAL MAINTENANCE COSTS ($000)	ALLOCATED TOTAL MAINTENANCE COSTS PERCENT
1 Standard Auto	$ 57,283	39.80%	$ 28,830	18.57%	$ 86,113	28.79%
2 Small Auto	31,293	21.74	10,125	6.52	41,418	13.85
3 Motorcycle	1,367	0.95	164	0.11	1,531	0.51
4 Intercity Bus	86	0.06	165	0.11	250	0.08
5 Other Bus	457	0.32	876	0.56	1,333	0.45
6 Pickup/Van	36,969	25.69	33,402	21.52	70,371	23.52
7 SU Truck <26	3,816	2.65	6,722	4.33	10,538	3.52
8 SU Truck >26	2,254	1.57	7,588	4.89	9,842	3.29
9 CU Truck <50	820	0.57	3,134	2.02	3,953	1.32
10 CU Truck 50-70	1,422	0.99	7,380	4.75	8,802	2.94
11 CU Truck 70-75	1,633	1.13	10,408	6.70	12,040	4.02
12 CU Truck >75	6,517	4.53	46,432	29.91	52,948	17.70
Totals	$143,917	100.00%	$155,224	100.00%	$299,141	100.00%
1 Autos	$ 88,577	61.55%	$ 38,955	25.10%	$127,532	42.63%
2 Motorcycles	1,367	0.95	164	0.11	1,531	0.51
3 Buses	543	0.38	1,041	0.67	1,583	0.53
4 Pickups/Vans	36,969	25.69	33,402	21.52	70,371	23.52
5 SU Trucks	6,070	4.22	14,310	9.22	20,380	6.81
6 CU Trucks	10,391	7.22	67,353	43.39	77,743	25.99
Totals	$143,917	100.00%	$155,224	100.00%	$299,141	100.00%
1 Passengers	$127,456	88.56%	$ 73,562	47.39%	$201,017	67.20%
2 Trucks	16,461	11.44	81,662	52.61	98,123	32.80
Totals	$143,917	100.00%	$155,224	100.00%	$299,141	100.00%

TABLE 6

TOTAL KANSAS FUNDS RESPONSIBILITY - DIVISION OF MOTOR VEHICLES
ALL VEHICLE TYPES

	VEHICLE TYPE	ALLOCATED TOTAL CARRIER COSTS ($000)	ALLOCATED TOTAL DRIVER LICENSE COSTS ($000)	ALLOCATED TOTAL REGISTRA-TION COSTS ($000)	ALLOCATED 1985-88 MOTOR VEHICLE COSTS ($000)	ALLOCATED 1985-88 MOTOR VEHICLE COSTS PERCENT
1	Standard Auto	$ 0	$ 9,026	$ 5,739	$ 14,765	26.73%
2	Small Auto	0	4,931	3,135	8,066	14.60
3	Motorcycle	0	992	631	1,623	2.94
4	Intercity Bus	0	3	2	4	0.01
5	Transit Bus	0	2	1	3	0.01
6	School Bus	0	93	59	152	0.28
7	SU-4T <6	0	0	0	0	0.00
8	SU-4T 6-10	0	0	0	0	0.00
9	SU-4T >10	0	5,285	3,360	8,644	15.65
10	SU-6T <19.5	2,093	236	150	2,480	4.49
11	SU-6T 19.5-26	2,514	281	179	2,973	5.38
12	SU-6T >26	853	86	54	993	1.80
13	SU-3AX <26	75	8	5	88	0.16
14	SU-3AX 26-33	262	28	17	307	0.56
15	SU-3AX 33-40	221	19	12	252	0.46
16	SU-3AX 40-50	1,428	108	69	1,605	2.91
17	SU-3AX >50	0	0	0	0	0.00
18	CU-3AX <26	0	0	0	0	0.00
19	CU-3AX 26-50	772	49	31	851	1.54
20	CU-3AX >50	24	1	1	26	0.05
21	CU-2S2 <50	208	10	6	224	0.41
22	CU-2S2 50-60	1,150	43	28	1,221	2.21
23	CU-2S2 >60	28	1	1	29	0.05
24	CU-4AX <50	19	1	1	21	0.04
25	CU-4AX 50-60	107	4	3	114	0.21
26	CU-4AX >60	3	0	0	3	0.01
27	CU-3S2 <50	7	0	0	7	0.01
28	CU-3S2 50-70	400	11	7	418	0.76
29	CU-3S2 70-75	1,840	39	25	1,904	3.45
30	CU-3S2 >75	7,350	144	91	7,585	13.73
31	CU-5AX <50	0	0	0	0	0.00
32	CU-5AX 50-70	23	1	1	25	0.04
33	CU-5AX 70-75	108	3	2	113	0.20
34	CU-5AX >75	433	9	6	448	0.81
35	CU-6AX+ <50	0	0	0	0	0.00
36	CU-6AX+ 50-70	11	0	0	11	0.02
37	CU-6AX+ 70-75	54	1	1	57	0.10
38	CU-6AX+ >75	212	4	3	219	0.40
	Totals	$ 20,196	$ 21,419	$ 13,618	$ 55,233	100.00%

TABLE 7

TOTAL KANSAS FUNDS RESPONSIBILITY - DIVISION OF MOTOR VEHICLES
COMBINED VEHICLE TYPES

VEHICLE TYPE	ALLOCATED TOTAL CARRIER COSTS ($000)	ALLOCATED TOTAL DRIVER LICENSE COSTS ($000)	ALLOCATED TOTAL REGISTRATION COSTS ($000)	ALLOCATED 1985-88 MOTOR VEHICLE COSTS ($000)	ALLOCATED 1985-88 MOTOR VEHICLE COSTS PERCENT
1 Standard Auto	$ 0	$ 9,026	$ 5,739	$ 14,765	26.73%
2 Small Auto	0	4,931	3,135	8,066	14.60
3 Motorcycle	0	992	631	1,623	2.94
4 Intercity Bus	0	3	2	4	0.01
5 Other Bus	0	95	60	156	0.28
6 Pickup/Van	0	5,285	3,360	8,644	15.65
7 SU Truck <26	4,682	525	334	5,541	10.03
8 SU Truck >26	2,765	240	153	3,158	5.72
9 CU Truck <50	1,006	60	38	1,104	2.00
10 CU Truck 50-70	1,745	62	39	1,846	3.34
11 CU Truck 70-75	2,003	43	27	2,073	3.75
12 CU Truck >75	7,995	157	100	8,253	14.94
Totals	$ 20,196	$ 21,419	$ 13,618	$ 55,233	100.00%
1 Autos	$ 0	$ 13,957	$ 8,873	$ 22,830	41.33%
2 Motorcycles	0	992	631	1,623	2.94
3 Buses	0	98	62	160	0.29
4 Pickups/Vans	0	5,285	3,360	8,644	15.65
5 SU Trucks	7,448	765	486	8,699	15.75
6 CU Trucks	12,749	322	205	13,276	24.04
Totals	$ 20,196	$ 21,419	$ 13,618	$ 55,233	100.00%
1 Passengers	$ 0	$ 20,332	$ 12,926	$ 33,258	60.21%
2 Trucks	20,196	1,087	691	21,975	39.79
Totals	$ 20,196	$ 21,419	$ 13,618	$ 55,233	100.00%

TABLE 8

TOTAL KANSAS FREEWAY DEBT SERVICE RESPONSIBILITY
ALL VEHICLE TYPES

	VEHICLE TYPE	ALLO-CATED TOTAL ROWGRDR COSTS ($000)	ALLO-CATED TOTAL PAVEMENT COSTS ($000)	ALLO-CATED TOTAL SHOULDER COSTS ($000)	ALLO-CATED TOTAL BRIDGE COSTS ($000)	ALLO-CATED TOTAL MISC CONST COSTS ($000)	ALLO-CATED TOTAL 1985-88 COSTS ($000)	ALLO-CATED TOTAL 1985-88 COSTS PERCENT	ALLO-CATED TOTAL 1985-88 DEBT SERVICE ($000)
1	Standard Auto	$ 6,950	$ 3,833	$ 489	$ 1,911	$ 29	$ 13,212	27.68%	$ 23,413
2	Small Auto	3,797	2,076	267	1,044	16	7,200	15.08	12,759
3	Motorcycle	166	91	12	46	1	314	0.66	557
4	Intercity Bus	17	33	7	13	0	71	0.15	126
5	Transit Bus	8	12	3	6	0	29	0.06	52
6	School Bus	83	215	34	59	0	390	0.82	691
7	SU-4T <6	0	0	0	0	0	0	0.00	0
8	SU-4T 6-10	0	0	0	0	0	0	0.00	0
9	SU-4T >10	4,486	2,772	315	1,233	19	8,825	18.49	15,639
10	SU-6T <19.5	339	236	138	240	1	953	2.00	1,689
11	SU-6T 19.5-26	407	509	165	312	1	1,394	2.92	2,471
12	SU-6T >26	138	202	56	116	0	513	1.07	909
13	SU-3AX <26	12	20	5	10	0	47	0.10	84
14	SU-3AX 26-33	42	124	17	36	0	220	0.46	389
15	SU-3AX 33-40	36	86	15	33	0	169	0.35	300
16	SU-3AX 40-50	231	660	94	241	1	1,227	2.57	2,174
17	SU-3AX >50	0	0	0	0	0	0	0.00	0
18	CU-3AX <26	0	0	0	0	0	0	0.00	0
19	CU-3AX 26-50	125	214	51	130	0	520	1.09	922
20	CU-3AX >50	4	7	2	4	0	16	0.03	28
21	CU-2S2 <50	34	38	14	34	0	120	0.25	212
22	CU-2S2 50-60	186	455	76	188	0	906	1.90	1,605
23	CU-2S2 >60	5	13	2	5	0	24	0.05	43
24	CU-4AX <50	3	4	1	3	0	11	0.02	20
25	CU-4AX 50-60	17	58	7	17	0	99	0.21	176
26	CU-4AX >60	0	1	0	0	0	2	.00	4
27	CU-3S2 <50	1	3	0	1	0	6	0.01	10
28	CU-3S2 50-70	65	240	26	78	0	409	0.86	725
29	CU-3S2 70-75	298	1,158	121	361	1	1,938	4.06	3,434
30	CU-3S2 >75	1,190	5,051	484	1,440	3	8,167	17.11	14,473
31	CU-5AX <50	0	0	0	0	0	0	0.00	0
32	CU-5AX 50-70	4	5	2	5	0	15	0.03	26
33	CU-5AX 70-75	18	73	7	21	0	119	0.25	211
34	CU-5AX >75	70	307	29	85	0	491	1.03	870
35	CU-6AX+ <50	0	0	0	0	0	0	0.00	0
36	CU-6AX+ 50-70	2	5	1	2	0	9	0.02	16
37	CU-6AX+ 70-75	9	43	4	11	0	67	0.14	119
38	CU-6AX+ >75	34	157	14	44	0	249	0.52	442
	Totals	$ 18,776	$ 18,698	$ 2,455	$ 7,731	$ 74	$ 47,734	100.00%	$ 84,591

TABLE 9

TOTAL KANSAS FREEWAY DEBT SERVICE RESPONSIBILITY
COMBINED VEHICLE TYPES

	VEHICLE TYPE	ALLO-CATED TOTAL ROWGRDR COSTS ($000)	ALLO-CATED TOTAL PAVEMENT COSTS ($000)	ALLO-CATED TOTAL SHOULDER COSTS ($000)	ALLO-CATED TOTAL BRIDGE COSTS ($000)	ALLO-CATED TOTAL MISC CONST COSTS ($000)	ALLO-CATED TOTAL 1985-88 COSTS ($000)	ALLO-CATED TOTAL 1985-88 COSTS PERCENT	ALLO-CATED TOTAL 1985-88 DEBT SERVICE ($000)
1	Standard Auto	$ 6,950	$ 3,833	$ 489	$1,911	$29	$13,212	27.68%	$23,413
2	Small Auto	3,797	2,076	267	1,044	16	7,200	15.08	12,759
3	Motorcycle	166	91	12	46	1	314	0.66	557
4	Intercity Bus	17	33	7	13	0	71	0.15	126
5	Other Bus	91	226	37	65	0	419	0.88	743
6	Pickup/Van	4,486	2,772	315	1,233	19	8,825	18.49	15,639
7	SU Truck <26	758	765	308	562	2	2,395	5.02	4,244
8	SU Truck >26	448	1,072	182	426	1	2,129	4.46	3,773
9	CU Truck <50	163	260	66	169	0	657	1.38	1,165
10	CU Truck 50-70	282	782	115	300	1	1,480	3.10	2,623
11	CU Truck 70-75	324	1,274	132	393	1	2,124	4.45	3,764
12	CU Truck >75	1,294	5,515	526	1,569	3	8,907	18.66	15,785
	Totals	$18,776	$18,698	$2,455	$7,731	$74	$47,734	100.00%	$84,591
1	Auto	$10,747	$ 5,908	$ 755	$2,955	$46	$20,411	42.76%	$36,172
2	Motorcycle	166	91	12	46	1	314	0.66	557
3	Bus	108	260	44	78	0	490	1.03	869
4	Pickup/Van	4,486	2,772	315	1,233	19	8,825	18.49	15,639
5	SU Truck	1,206	1,837	490	988	3	4,524	9.48	8,017
6	CU Truck	2,064	7,830	839	2,431	5	13,169	27.59	23,338
	Totals	$18,776	$18,698	$2,455	$7,731	$74	$47,734	100.00%	$84,591
1	Pass Vehicles	$15,506	$ 9,031	$1,126	$4,312	$ 66	$30,041	62.93%	$53,237
2	Trucks	3,270	9,667	1,329	3,419	8	17,693	37.07	31,354
	Totals	$18,776	$18,698	$2,455	$7,731	$74	$47,734	100.00%	$84,591

TABLE 10

TOTAL KANSAS FUNDS RESPONSIBILITY - ALL COSTS
ALL VEHICLE TYPES

VEHICLE TYPE	ALLO-CATED 1985-88 CONST COSTS ($000)	ALLO-CATED 1985-88 MAINT COSTS ($000)	ALLO-CATED 1985-88 MOTOR VEHICLE COSTS ($000)	ALLO-CATED 1985-88 DEBT SERVICE ($000)	ALLO-CATED 1985-88 SUBTOTAL COSTS ($000)	ALLO-CATED 1985-88 SUBTOTAL COSTS PERCENT	ALLO-CATED 1985-88 ADMIN COSTS ($000)	ALLO-CATED 1985-88 TOTAL COSTS ($000)
1 Standard Auto	$ 56,586	$ 86,113	$14,765	$23,413	$180,877	25.77%	$ 73,933	$254,810
2 Small Auto	30,750	41,418	8,066	12,759	92,993	13.25	38,011	131,003
3 Motorcycle	1,343	1,531	1,623	557	5,054	0.72	2,066	7,120
4 Intercity Bus	477	250	4	126	857	0.12	350	1,208
5 Transit Bus	193	119	3	52	367	0.05	150	517
6 School Bus	2,704	1,214	152	691	4,761	0.68	1,946	6,708
7 SU-4T <6	0	0	0	0	0	0.00	0	0
8 SU-4T 6-10	0	0	0	0	0	0.00	0	0
9 SU-4T >10	39,571	70,371	8,644	15,639	134,226	19.13	54,865	189,901
10 SU-6T <19.5	5,629	4,225	2,480	1,689	14,024	2.00	5,732	19,756
11 SU-6T 19.5-26	9,180	6,129	2,973	2,471	20,752	2.96	8,482	29,234
12 SU-6T >26	3,555	2,479	993	909	7,937	1.13	3,244	11,181
13 SU-3AX <26	311	184	88	84	667	0.10	273	940
14 SU-3AX 26-33	1,555	762	307	389	3,013	0.43	1,232	4,245
15 SU-3AX 33-40	1,226	749	252	300	2,527	0.36	1,033	3,559
16 SU-3AX >40-50	9,233	5,852	1,605	2,174	18,865	2.69	7,711	26,575
17 SU-3AX >50	0	0	0	0	0	0.00	0	0
18 CU-3AX <26	0	0	0	0	0	0.00	0	0
19 CU-3AX 26-50	3,789	3,162	851	922	8,725	1.24	3,566	12,291
20 CU-3AX >50	118	115	26	28	287	0.04	117	404
21 CU-2S2 <50	811	703	224	212	1,950	0.28	797	2,747
22 CU-2S2 50-60	6,581	5,566	1,221	1,605	14,973	2.13	6,120	21,093
23 CU-2S2 >60	188	156	29	43	416	0.06	170	586
24 CU-4AX <50	78	65	21	20	184	0.03	75	259
25 CU-4AX 50-60	704	516	114	176	1,511	0.22	617	2,128
26 CU-4AX >60	16	15	3	4	37	0.01	15	52
27 CU-3S2 <50	42	23	7	10	81	0.01	33	114
28 CU-3S2 50-70	3,191	2,242	418	725	6,576	0.94	2,688	9,263
29 CU-3S2 70-75	15,004	11,062	1,904	3,434	31,404	4.47	12,836	44,240
30 CU-3S2 >75	62,485	48,675	7,585	14,473	133,218	18.98	54,452	187,671
31 CU-5AX <50	2	1	0	0	4	0.00	2	6
32 CU-5AX 50-70	103	132	25	26	285	0.04	116	401
33 CU-5AX 70-75	920	652	113	211	1,895	0.27	775	2,670
34 CU-5AX >75	3,843	2,869	448	870	8,031	1.14	3,283	11,313
35 CU-6AX+ <50	1	1	0	0	2	0.00	1	3
36 CU-6AX+ 50-70	69	60	11	16	158	0.02	64	222
37 CU-6AX+ 70-75	554	326	57	119	1,056	0.15	431	1,487
38 CU-6AX+ >75	2,023	1,404	219	442	4,089	0.58	1,671	5,760
Totals	$262,834	$299,141	$55,233	$84,591	$701,800	100.00%	$286,858	$988,658

TABLE 11

TOTAL KANSAS FUNDS RESPONSIBILITY - ALL COSTS
COMBINED VEHICLE TYPES

VEHICLE TYPE	ALLOCATED 1985-88 CONST COSTS ($000)	ALLOCATED 1985-88 MAINT COSTS ($000)	ALLOCATED 1985-88 MOTOR VEHICLE COSTS ($000)	ALLOCATED 1985-88 DEBT SERVICE ($000)	ALLOCATED 1985-88 SUBTOTAL COSTS ($000)	ALLOCATED 1985-88 SUBTOTAL COSTS PERCENT	ALLOCATED 1985-88 ADMIN COSTS ($000)	ALLOCATED 1985-88 TOTAL COSTS ($000)
1 Standard Auto	$ 56,586	$ 86,113	$14,765	$23,413	$180,877	25.77%	$ 73,933	$254,810
2 Small Auto	30,750	41,418	8,066	12,759	92,993	13.25	38,011	131,003
3 Motorcycle	1,343	1,531	1,623	557	5,054	0.72	2,066	7,120
4 Intercity Bus	477	250	4	126	857	0.12	350	1,208
5 Other Bus	2,897	1,333	156	743	5,128	0.73	2,096	7,225
6 Pickup/Van	39,571	70,371	8,644	15,639	134,226	19.13	54,865	189,091
7 SU Truck <26	15,121	10,538	5,541	4,244	35,443	5.05	14,487	49,930
8 SU Truck >26	15,568	9,842	3,158	3,773	32,341	4.61	13,219	45,560
9 CU Truck <50	4,722	3,953	1,104	1,165	10,946	1.56	4,474	15,420
10 CU Truck 50-70	10,969	8,802	1,846	2,623	24,241	3.45	9,908	34,149
11 CU Truck 70-75	16,478	12,040	2,073	3,764	34,355	4.90	14,042	48,397
12 CU Truck >75	68,352	52,948	8,253	15,785	145,338	20.71	59,406	204,744
Totals	$262,833	$299,141	$55,233	$84,591	$701,800	100.00%	$286,858	$988,658

VEHICLE TYPE	CONST	MAINT	MOTOR VEHICLE	DEBT SERVICE	SUBTOTAL COSTS	PERCENT	ADMIN	TOTAL
1 Autos	$87,336	$127,532	$22,830	$36,172	$273,870	39.02%	$111,943	$385,813
2 Motorcycles	1,343	1,531	1,623	557	5,054	0.72	2,066	7,120
3 Buses	3,374	1,583	160	869	5,986	0.85	2,447	8,432
4 Pickups/Vans	39,571	70,371	8,644	15,639	134,226	19.13	54,865	189,091
5 SU Trucks	30,689	22,380	8,699	8,017	67,784	9.66	27,707	95,491
6 CU Trucks	100,521	77,743	13,276	23,338	214,879	30.62	87,831	302,711
Totals	$262,833	$299,141	$55,233	$84,591	$701,800	100.00%	$286,858	$988,658

VEHICLE TYPE	CONST	MAINT	MOTOR VEHICLE	DEBT SERVICE	SUBTOTAL COSTS	PERCENT	ADMIN	TOTAL
1 Passengers	$131,624	$201,217	$33,258	$53,237	$419,136	59.72%	$171,320	$590,457
2 Trucks	131,209	98,123	21,975	31,354	282,664	40.28	115,538	398,201
Totals	$262,833	$299,141	$55,233	$84,591	$701,800	100.00%	$286,858	$988,658

TABLE 12

ALLOCATED COST PER VEHICLE PER YEAR AND PER VMT
ALL VEHICLE TYPES

VEHICLE TYPE	AVERAGE ANNUAL COST PER VEHICLE	AVERAGE UNIT COST PER VMT
1 Standard Auto	$ 87.05	$0.008
2 Small Auto	81.72	0.008
3 Motorcycle	22.26	0.010
4 Intercity Bus	1,432.28	0.026
5 Transit Bus	759.50	0.024
6 School Bus	221.10	0.030
7 SU-4T <6	0.00	0.000
8 SU-4T 6-10	0.00	0.000
9 SU-4T >10	110.81	0.010
10 SU-6T <19.5	258.76	0.022
11 SU-6T 19.5-26	322.17	0.027
12 SU-6T >26	404.89	0.030
13 SU-3AX <26	371.34	0.029
14 SU-3AX 26-33	475.81	0.037
15 SU-3AX 33-40	583.86	0.037
16 SU-3AX 40-50	760.79	0.043
17 SU-3AX >50	0.00	0.000
18 CU-3AX <26	0.00	0.000
19 CU-3AX 26-50	784.08	0.037
20 CU-3AX >50	986.91	0.039
21 CU-2S2 <50	852.18	0.030
22 CU-2S2 50-60	1,511.12	0.042
23 CU-2S2 >60	2,198.48	0.049
24 CU-4AX <50	772.31	0.031
25 CU-4AX 50-60	1,539.53	0.046
26 CU-4AX >60	2,172.70	0.045
27 CU-3S2 <50	1,904.28	0.039
28 CU-3S2 50-70	2,602.12	0.053
29 CU-3S2 70-75	3,543.21	0.055
30 CU-3S2 >75	4,049.32	0.059
31 CU-5AX <50	1,450.04	0.035
32 CU-5AX 50-70	1,512.12	0.039
33 CU-5AX 70-75	3,114.30	0.056
34 CU-5AX >75	3,842.70	0.060
35 CU-6AX+ <50	844.84	0.046
36 CU-6AX+ 50-70	1,594.94	0.047
37 CU-6AX+ 70-75	3,158.77	0.063
38 CU-6AX+ >75	4,166.93	0.062
Totals	$ 142.76	$0.013

TABLE 13

ALLOCATED COST PER VEHICLE PER YEAR AND PER VMT
COMBINED VEHICLE TYPES

VEHICLE TYPE	AVERAGE ANNUAL COST PER VEHICLE	AVERAGE UNIT COST PER VMT
1 Standard Auto	$ 87.05	$0.008
2 Small Auto	81.72	0.008
3 Motorcycle	22.26	0.010
4 Intercity Bus	1,432.28	0.026
5 Other Bus	232.93	0.030
6 Pickup/Van	110.81	0.010
7 SU Truck <26	294.37	0.024
8 SU Truck >26	587.44	0.038
9 CU Truck <50	799.02	0.035
10 CU Truck 50-70	1,706.88	0.045
11 CU Truck 70-75	3,503.52	0.055
12 CU Truck >75	4,040.53	0.059
Totals	$ 142.76	$0.013
1 Auto	$ 85.17	$0.008
2 Motorcycle	22.26	0.010
3 Bus	264.65	0.029
4 Pickup/Van	110.81	0.010
5 SU Truck	386.39	0.029
6 CU Truck	2,916.19	0.054
Totals	$ 142.76	$0.013
1 Passengers	$ 89.63	$0.009
2 Trucks	1,136.35	0.045
Totals	$ 142.76	$0.013

TABLE 14

VEHICLE TYPES USED FOR
ANALYTICAL AND REPORTING PURPOSES

38 VEHICLE TYPES[1]	12 VEHICLE TYPES[2]	6 VEHICLE TYPES[2]	2 VEHICLE TYPES[2]	DESCRIPTION	GROSS REGISTER WEIGHT (1,000)
1	1	1	1	Standard Auto	
2	2	1	1	Small Auto	
3	3	2	1	Motorcycle	
4	4	3	1	Intercity Bus	
5	5	3	1	Transit Bus	
6	5	3	1	School Bus	
7	6	4	1	SU-4 Tires	<6
8	6	4	1	SU-4 Tires	6-10
9	6	4	1	SU-4 Tires	>10
10	7	5	2	SU-6 Tires	<19.5
11	7	5	2	SU-6 Tires	19.5-26
12	8	5	2	SU-6 Tires	>26
13	7	5	2	SU-3 Axles	<26
14	8	5	2	SU-3 Axles	26-33
15	8	5	2	SU-3 Axles	33-40
16	8	5	2	SU-3 Axles	40-50
17	8	5	2	SU-3 Axles	>50
18	9	6	2	CU-3 Axles	<26
19	10	6	2	CU-3 Axles	26-50
20	10	6	2	CU-3 Axles	>50
21	9	6	2	CU-2S2	<50
22	9	6	2	CU-2S2	50-60
23	10	6	2	CU-2S2	>60
24	9	6	2	CU-4 Axles	<50
25	10	6	2	CU-4 Axles	50-60
26	10	6	2	CU-4 Axles	>60
27	9	6	2	CU-3S2	<50
28	10	6	2	CU-3S2	50-70
29	11	6	2	CU-3S2	70-75
30	12	6	2	CU-3S2	>75
31	9	6	2	CU-5 Axles	<50
32	10	6	2	CU-5 Axles	50-70
33	11	6	2	CU-5 Axles	70-75
34	12	6	2	CU-5 Axles	>75
35	9	6	2	CU-6+ Axles	<50
36	10	6	2	CU-6+ Axles	50-70
37	11	6	2	CU-6+ Axles	70-75
38	12	6	2	CU-6+ Axles	>75

1) Used in all analytical work
2) Used to report results

end of chapter 2   BLANK ON PURPOSE

BLANK ON PURPOSE

BLANK ON PURPOSE

CHAPTER 3
ATTRIBUTION OF REVENUES

This document provides a description of the technical considerations and revenue attribution techniques used in the Kansas Highway Cost Allocation Study.

TECHNICAL CONSIDERATIONS

The Kansas Highway Cost Allocation Study allocates only the net costs to the Kansas Department of Transportation. Federal-Aid, as well as other external fund sources, are excluded. Only Kansas revenues, for consistency and comparison purposes, will be attributed. The attribution techniques will need to recognize gross Kansas receipts and the statutory distribution to selected funds. The major selected funds are the Highway Fund, Freeway Fund, and the Special City/County Highway Fund. The Highway Fund finances most of the construction, maintenance, operations, and administration of the Kansas Department of Transportation. The Freeway Fund provides for debt service required for retirement of freeway bonds with any excess used for freeway construction and maintenance. The Special City/County Highway Fund provides for a portion of selected revenues to be shared with counties and cities. Most revenues are generated by vehicles and vehicle travel involving the total Kansas Highway System, which includes the Turnpike, Interstate, Freeway, the remainder of the Rural State Highway System, County Roads, and City Streets. Each revenue source will be examined to ascertain origin and destination. The revenues will be attributed to the same vehicle types used for cost allocation so that comparisons can be made between cost responsibility and generated revenue.

REVENUE SOURCES

The bulk of the revenue is derived from taxes on motor fuels for vehicle registrations, fees for vehicle operator licenses, special vehicle permits, a sales tax transfer from the general fund, and investment incomes derived from deposited Freeway and Highway Funds. Smaller amounts are derived from various sources and will be discussed later.

MOTOR FUEL TAX ATTRIBUTION

The State of Kansas, by statute, has a Consensus Committee charged with estimating revenues. Included are estimates of revenues derived from motor fuel taxes and certain fees charged in lieu of motor fuel taxes.

The net tax values represent the taxes derived from motor fuel, or its equivalent, consumed on the various highway systems in Kansas. The refund amounts represent motor fuel used off the highway system and, in this analysis, is considered to be gasoline and will be deducted from the gasoline revenue. The Special Fuel Tax, Interstate Motor Fuels, and Motor Carrier Stations Trip Permits will be combined and considered to be diesel fuel taxes. A trip permit fee is $6.50 for a one time trip into Kansas and is considered by statute to be a type of fuel tax. The Consensus Committee used an econometric model in its predictions of dollars of revenue from motor fuel taxes for FY 1985 and FY 1986. The Office of Analysis and Evaluation used a regression analysis to estimate motor fuel taxes and certain fees charged in lieu of motor fuel taxes for fiscal years 1987 through 1991. Table 1, "ESTIMATED MOTOR FUEL REVENUES," shows the predictions for motor fuel taxes. Table 2, "ESTIMATED MOTOR FUEL CONSUMPTION," converts the estimated motor fuel taxes by fuel type to gallons of motor fuel.

In order to attribute revenue to the same vehicle types responsible for costs, an estimate of total travel by vehicle type and motor fuel consumption rates in miles per gallon must be established. The planning function of the Division of Planning and Development routinely forecasts traffic and have provided annual travel forecasts by vehicle type for the fiscal years of 1985 through 1988. Vehicles of the various vehicle types can and do use various fuel types. As an illustration, both cars and trucks can operate on gasoline, gasohol, LP Gas, or diesel fuel. The Federal Highway Administration (FHWA), in its 1982 Cost Allocation Study, developed relative proportions of vehicles powered by gasoline/gasohol, LP Gas, and diesel fuel. The Federal study also developed fuel efficiency rates (MPG) by the various vehicle types. An iterative procedure was used to attribute revenues.

The iteration procedure considered predicted motor fuel taxes and FHWA fleet fuel mixtures as being fixed values, with fuel efficiency rates (MPG) and travel data as being variable values. The first iteration developed fuel efficiency rates (MPG) by considering travel data as also being fixed. This iteration had some MPG values not consistent with a gradual increase in fuel efficiency. The second iteration eliminated the MPG inconsistencies through a sort of fuel efficiency by vehicle type. The third iteration developed revised travel data by considering the MPG values developed in iteration 2 as being fixed.

VEHICLE POPULATION AND TRAVEL DATA. Table 3, "VEHICLE POPULATION AND TRAVEL DATA," lists the vehicle population and travel data by the 38 vehicle classes used in the study. Table 4 is similar to Table 3 but shows the vehicle population and travel data by various combinations of vehicle types. Passenger vehicles account for 94.86% of the vehicle population and 88.49% of the travel. Trucks account for 5.14% of the vehicle population and 11.51% of the travel.

FUEL CONSUMPTION RATES. Table 5, "FUEL CONSUMPTION RATES," lists the fuel consumption rate expressed in miles per gallon (MPG) by the 38 vehicle classes used in the study. Table 6 is similar to Table 5 but shows the fuel consumption rates by various combinations of vehicle types. Passenger vehicles and trucks averaged 18.91 MPG and 5.96 MPG respectively.

ANNUAL GASOLINE CONSUMPTION. Table 7, "ANNUAL GASOLINE CONSUMPTION," lists the gasoline consumed during the 1985-88 study period by the 38 vehicle classes used in the study. Table 8 is similar to Table 7 but shows the gasoline consumption by various combinations of vehicles. Passenger vehicles consumed 90.39% and trucks 9.61% of the 3,307,273,000 gallons of gasoline consumed during the four year study period.

ANNUAL GASOHOL CONSUMPTION. Table 9, "ANNUAL GASOHOL CONSUMPTION," lists the gasohol consumed during the 1985-88 study period by the 38 vehicle classes used in the study. Table 10 is similar to Table 9 but shows the gasohol consumption by various combinations of vehicles. Passenger vehicles consumed 90.38% and trucks 9.62% of the 1,211,667,000 gallons gasohol consumed during the four year study period.

ANNUAL DIESEL CONSUMPTION. Table 11, "ANNUAL DIESEL CONSUMPTION," lists the diesel fuel consumed during the 1985-88 study period by the 38 vehicle classes used in the study. Table 12 is similar to Table 11 but shows the diesel fuel consumption by various combinations of vehicles. Passenger vehicles consumed 4.06% and trucks 95.94% of the 1,133,077,000 gallons of diesel fuel consumed during the four year study period.

ANNUAL LP GAS CONSUMPTION. Table 13, "ANNUAL LP GAS CONSUMPTION," lists the LP Gas consumed during the 1985-88 study period by the 38 vehicle classes used in the study. Table 14 is similar to Table 13 but shows the LP Gas consumption by various combinations of vehicles. Passenger vehicles account for 54.84% and trucks 45.16% of the 36,000,000 gallons of LP Gas consumed during the four year study period.

ANNUAL FUEL CONSUMPTION. Table 15, "ANNUAL FUEL CONSUMPTION," summarizes Tables 5, 7, 9 and 11 and lists the total motor fuel consumed during the 1985-88 study period by the 38 vehicle classes used in the study. Table 16 is similar to Table 15 but shows the total motor fuel consumption by various combinations of vehicles. Passenger vehicles account for 73.00% and trucks 27.00% of the 5,698,016,000 gallons motor fuel consumed during the base year study period.

MOTOR FUEL TAXES PER VEHICLE PER YEAR AND PER VMT. A primary purpose of a cost allocation study is to ascertain the revenues generated by each vehicle. Table 17, "MOTOR FUEL TAXES," shows the annual motor fuel tax generated by each of the 38 vehicle classes used in the study. Table 17 also shows the fuel tax expressed in revenue per vehicle mile travelled. The average annual fuel tax ranges from $4 for a motorcycle to $1,574 for a SU-3S2 registered for more than 75,000 pounds. The average fuel tax per vehicle mile travelled ranges from $0.002 for a motorcycle to $0.025 for several combination unit truck-trailer.

Table 18 is similar to Table 17 but aggregates the Annual Motor Motor Fuel Taxes and costs per vehicle mile travelled for various combinations of vehicles. The aggregate shifts revenues from heavier vehicles to lighter vehicles within the combined class. The revenue shift clearly demonstrates the need to use as many vehicle classes as is practicable.

TABLE 1

ESTIMATED MOTOR FUEL REVENUE
($000,000)

FUEL TYPE	FY 1985	FY 1986	FY 1987	FY 1988	FY TOTAL 1985-88
Gasoline	$102.0	$97.0	$95.0	$94.6	$388.6
Gasohol	16.0	19.0	19.2	19.1	73.3
Special	26.8	28.4	29.8	31.3	116.3
LP Gas	0.9	0.9	0.9	0.9	3.6
Interstate Motor Fuel	6.0	6.2	7.2	7.6	27.0
Motor Carrier Station	1.0	1.0	1.0	1.0	4.0
Gross Tax	$152.7	$152.5	$153.1	$154.5	$612.8
Refunds	6.2	6.5	6.1	6.0	24.8
Net Tax	$146.5	$146.0	$147.0	$148.5	$588.0

TABLE 2

ESTIMATED MOTOR FUEL CONSUMPTION
REVENUE
($000)

FUEL TYPE	TAX PER GALLON	FY 1985	FY 1986	FY 1987	FY 1988	FY 1985-88
Gasoline	$0.11	$ 95,800	$ 90,500	$ 88,900	$ 88,600	$363,800
Gasohol	0.06	16,000	19,000	19,200	19,100	73,300
LP Gas	0.10	900	900	900	900	3,600
Diesel	0.13	33,800	35,600	38,000	39,900	147,300
Totals		$146,500	$146,000	$147,000	$148,500	$588,000

GALLONS
(000)

FUEL TYPE	TAX PER GALLON	FY 1985	FY 1986	FY 1987	FY 1988	FY 1985-88
Gasoline	$0.11	870,909	822,727	808,182	805,455	3,307,273
Gasohol	0.06	266,667	316,667	320,000	318,333	1,221,667
LP Gas	0.10	9,000	9,000	9,000	9,000	360,000
Diesel	0.13	260,000	273,846	292,308	306,923	1,133,077
Totals		1,406,576	1,422,240	1,429,490	1,439,711	5,698,017

TABLE 3

VEHICLE POPULATION AND TRAVEL DATA
ALL VEHICLE CLASSES

	VEHICLE TYPE	VEHICLE POP (UNITS)	VEHICLE POP PERCENT	1985 ANNUAL VMT (000)	1986 ANNUAL VMT (000)	1987 ANNUAL VMT (000)	1988 ANNUAL VMT (000)	1985-88 ANNUAL VMT (000)	AVG. ANNUAL VMT PER VEHICLE	1985-88 ANNUAL VMT PERCENT
1	Standard Auto	729,600	42.12%	7,896,445	7,737,612	7,516,703	7,300,228	30,450,989	10,434	39.76%
2	Small Auto	389,575	23.01	3,749,201	4,038,768	4,300,572	4,522,275	16,640,815	10,438	21.73
3	Motorcycle	80,221	4.63	178,741	183,621	182,997	185,970	731,329	2,279	0.95
4	Intercity Bus	209	0.01	10,957	11,291	11,574	11,828	45,649	54,605	0.06
5	Transit Bus	169	0.01	5,122	5,339	5,510	5,698	21,669	32,055	0.03
6	School Bus	7,253	0.42	55,007	56,315	54,570	55,630	221,521	7,636	0.29
7	SU-4T <6	0	0.00	0	0	0	0	0	0	0.00
8	SU-4T 6-10	0	0.00	0	0	0	0	0	0	0.00
9	SU-4T >10	427,170	24.66	4,765,653	4,885,386	4,966,855	5,035,929	19,653,824	11,502	25.66
10	SU-6T <19.5	19,087	1.10	225,086	229,763	225,394	229,394	909,637	11,914	1.19
11	SU-6T 19.5-26	22,697	1.31	270,295	275,804	273,302	276,789	1,096,189	12,074	1.43
12	SU-6T >26	6,917	0.40	85,794	90,559	95,360	100,141	371,854	13,440	0.49
13	SU-3AX <26	632	0.04	8,123	8,227	8,226	8,327	32,903	13,016	0.04
14	SU-3AX 26-33	2,224	0.13	26,544	28,044	29,117	30,663	114,369	12,856	0.15
15	SU-3AX 33-40	1,525	0.09	22,273	23,674	24,574	26,050	96,570	15,831	0.13
16	SU-3AX 40-50	8,748	0.57	143,378	152,520	158,772	168,448	623,118	15,818	0.81
17	SU-3AX >50	0	0.00	0	0	0	0	0	0	0.00
18	CU-3AX <26	0	0.00	0	0	0	0	0	0	0.00
19	CU-3AX 26-50	3,938	0.23	76,479	80,927	87,466	92,042	336,913	21,389	0.44
20	CU-3AX >50	103	0.01	2,340	2,493	2,685	2,845	10,363	25,153	0.01
21	CU-2S2 <50	809	0.05	20,532	21,847	23,425	24,804	90,607	28,000	0.12
22	CU-2S2 50-60	3,505	0.20	113,101	120,026	130,850	138,128	502,106	35,814	0.66
23	CU-2S2 >60	67	0.00	2,728	2,893	3,170	3,350	12,141	45,303	0.02
24	CU-4AX <50	84	0.00	1,902	2,023	2,148	2,274	8,347	24,842	0.01
25	CU-4AX 50-60	346	0.02	10,506	11,181	12,081	12,800	46,568	33,647	0.06
26	CU-4AX >60	6	0.00	257	274	299	316	1,145	47,711	0.00
27	CU-3S2 <50	15	0.00	655	698	761	806	2,921	48,678	0.00
28	CU-3S2 50-70	893	0.05	39,285	41,875	45,322	48,133	174,616	48,885	0.23
29	CU-3S2 70-75	3,133	0.18	180,867	192,847	208,759	221,708	804,181	64,170	1.05
30	CU-3S2 >75	11,632	0.67	720,949	767,897	836,211	886,836	3,211,893	69,031	4.19
31	CU-5AX <50	1	0.00	37	39	43	46	164	41,087	0.00
32	CU-5AX 50-70	67	0.00	2,295	2,436	2,677	2,832	10,241	38,211	0.01
33	CU-5AX 70-75	215	0.01	10,643	11,328	12,320	13,034	47,325	55,029	0.06
34	CU-5AX >75	739	0.04	42,625	45,421	49,145	52,165	189,356	64,058	0.25
35	CU-6+AX <50	1	0.00	16	18	19	21	74	18,540	0.00
36	CU-6+AX 50-70	35	0.00	1,054	1,118	1,227	1,295	4,694	33,528	0.01
37	CU-6+AX 70-75	118	0.01	5,332	5,698	6,138	6,536	23,704	50,219	0.03
38	CU-6+AX >75	347	0.02	20,780	22,081	24,170	25,570	92,601	66,716	0.12
	Totals	1,732,181	100.00%	18,695,002	19,060,043	19,302,439	19,522,910	76,580,395	11,053	100.00%

TABLE 4

VEHICLE POPULATION AND TRAVEL DATA
COMBINED VEHICLE CLASSES

VEHICLE TYPE	VEHICLE POP (UNITS)	VEHICLE POP PERCENT	1985 ANNUAL VMT (000)	1986 ANNUAL VMT (000)	1987 ANNUAL VMT (000)	1988 ANNUAL VMT (000)	1985-88 ANNUAL VMT (000)	AVG. ANNUAL VMT PER VEHICLE	1985-88 ANNUAL VMT PERCENT
1 Standard Auto	729,600	42.12%	7,896,445	7,737,612	7,516,703	7,300,228	30,450,989	10,434	39.76%
2 Small Auto	398,575	23.01	3,749,201	4,038,768	4,303,572	4,552,275	16,640,815	10,438	21.73
3 Motorcycle	80,221	4.63	178,741	183,621	182,997	185,970	731,329	2,279	0.95
4 Intercity Bus	209	0.01	10,957	11,291	11,574	11,828	45,649	54,605	0.06
5 Other Bus	7,422	0.43	60,129	61,654	60,080	61,327	243,190	8,192	0.32
6 Pickup/Van	427,170	24.66	4,765,653	4,885,386	4,966,855	5,035,929	19,653,824	11,502	25.66
7 SU Truck <26	42,416	2.45	503,504	513,794	506,921	514,510	2,038,729	12,016	2.66
8 SU Truck >26	20,514	1.18	277,988	294,797	307,822	325,303	1,205,910	14,696	1.57
9 CU Truck <50	4,848	0.28	99,621	105,552	113,861	119,992	439,027	22,640	0.57
10 CU Truck 50-70	5,022	0.29	171,567	182,295	198,311	209,700	761,874	37,927	0.99
11 CU Truck 70-75	3,466	0.20	196,842	209,873	227,217	241,278	875,210	63,128	1.14
12 CU Truck >75	12,718	0.73	784,354	835,399	909,526	964,571	3,493,850	68,679	4.56
Totals	1,732,181	100.00%	18,695,002	19,060,043	19,302,439	19,522,910	76,580,395	316,536	100.00%
1 Auto	1,128,175	65.13%	11,645,646	11,776,380	11,817,274	11,852,503	47,091,804	10,435	61.49%
2 Motorcycle	80,221	4.63	178,741	183,621	182,997	185,970	731,329	2,279	0.95
3 Bus	7,631	0.44	71,086	72,945	71,654	73,155	288,840	9,463	0.38
4 Pickup/Van	427,170	24.66	4,765,653	4,885,386	4,966,855	5,035,929	19,653,824	11,502	25.66
5 SU Truck	62,930	3.63	781,492	808,591	814,744	839,813	3,244,639	12,890	4.24
6 CU Truck	26,054	1.50	1,252,384	1,333,120	1,448,915	1,535,541	5,569,960	53,446	7.27
Totals	1,732,181	100.00%	18,695,022	19,060,043	19,302,439	19,522,910	76,580,395	100,016	100.00%
1 Pass Vehicles	1,643,197	94.86%	16,661,127	16,918,332	17,038,781	17,147,556	67,765,796	10,310	88.49%
2 Trucks	88,984	5.14	2,033,876	2,141,711	2,263,659	2,375,354	8,814,599	24,765	11.51
Totals	1,732,181	100.00%	18,695,002	19,060,043	19,302,439	19,522,910	76,580,395	35,075	100.00%

TABLE 5

FUEL CONSUMPTION RATES
ALL VEHICLE CLASSES

VEHICLE TYPE	1985 COMBINED MOTOR FUEL MPG	1986 COMBINED MOTOR FUEL MPG	1987 COMBINED MOTOR FUEL MPG	1988 COMBINED MOTOR FUEL MPG	1985-88 COMBINED MOTOR FUEL MPG
1 Standard Auto	13.29	13.40	13.50	13.56	13.44
2 Small Auto	24.68	24.92	25.23	25.41	25.08
3 Motorcycle	49.49	49.93	51.25	51.43	50.52
4 Intercity Bus	5.69	5.78	5.83	5.87	5.79
5 Transit Bus	3.70	3.76	3.79	3.82	3.77
6 School Bus	7.27	7.37	7.43	7.53	7.40
7 SU-4T <6	0.00	0.00	0.00	0.00	0.00
8 SU-4T 6-10	0.00	0.00	0.00	0.00	0.00
9 SU-4T >10	13.34	13.50	13.64	13.74	13.56
10 SU-6T <19.5	6.72	6.78	6.83	6.90	6.81
11 SU-6T 19.5-26	6.17	6.22	6.32	6.35	6.26
12 SU-6T >26	5.66	5.66	5.73	5.75	5.70
13 SU-3AX <26	6.36	6.36	6.43	6.44	6.40
14 SU-3AX 26-33	5.72	5.73	5.78	5.80	5.76
15 SU-3AX 33-40	5.38	5.42	5.44	5.49	5.43
16 SU-3AX 40-50	4.92	4.96	4.97	5.02	4.97
17 SU-3AX >50	0.00	0.00	0.00	0.00	0.00
18 CU-3AX <26	0.00	0.00	0.00	0.00	0.00
19 CU-3AX 26-50	5.40	5.41	5.49	5.50	5.45
20 CU-3AX >50	5.53	5.57	5.65	5.69	5.61
21 CU-2S2 <50	5.66	5.70	5.77	5.81	5.74
22 CU-2S2 50-60	5.40	5.42	5.52	5.54	5.47
23 CU-2S2 >60	5.50	5.52	5.64	5.67	5.59
24 CU-4AX <50	5.61	5.65	5.69	5.73	5.67
25 CU-4AX 50-60	5.46	5.50	5.59	5.63	5.55
26 CU-4AX >60	4.94	4.98	5.07	5.10	5.03
27 CU-3S2 <50	5.40	5.44	5.55	5.59	5.50
28 CU-3S2 50-70	5.56	5.61	5.71	5.76	5.66
29 CU-3S2 70-75	5.52	5.57	5.67	5.72	5.62
30 CU-3S2 >75	5.51	5.55	5.66	5.70	5.61
31 CU-5AX <50	5.44	5.49	5.61	5.66	5.56
32 CU-5AX 50-70	5.43	5.45	5.57	5.60	5.52
33 CU-5AX 70-75	5.19	5.23	5.33	5.36	5.28
34 CU-5AX >75	5.53	5.58	5.68	5.73	5.63
35 CU-6+AX <50	5.35	5.40	5.52	5.56	5.46
36 CU-6+AX 50-70	5.02	5.03	5.14	5.16	5.09
37 CU-6+AX 70-75	5.53	5.59	5.68	5.74	5.64
38 CU-6+AX >75	5.40	5.43	5.55	5.58	5.49
Totals	13.29	13.40	13.50	13.56	13.44

TABLE 6

FUEL CONSUMPTION RATES
COMBINED VEHICLE CLASSES

VEHICLE TYPE	1985 COMBINED MOTOR FUEL MPG	1986 COMBINED MOTOR FUEL MPG	1987 COMBINED MOTOR FUEL MPG	1988 COMBINED MOTOR FUEL MPG	1985-88 COMBINED MOTOR FUEL MPG
1 Standard Auto	15.09	15.26	15.41	15.54	15.32
2 Small Auto	24.68	24.92	25.23	25.41	25.08
3 Motorcycle	49.49	49.93	51.25	51.43	50.52
4 Intercity Bus	5.69	5.69	5.83	5.87	5.79
5 Other Bus	7.19	7.28	7.35	7.45	7.31
6 Pickup/Van	13.34	13.50	13.64	13.74	13.56
7 SU Truck <26	6.42	6.47	6.55	6.60	6.51
8 SU Truck >26	5.29	5.31	5.35	5.39	5.34
9 CU Truck <50	5.45	5.46	5.54	5.56	5.50
10 CU Truck 50-70	5.43	5.46	5.56	5.59	5.51
11 CU Truck 70-75	5.50	5.55	5.65	5.70	5.60
12 CU Truck >75	5.51	5.55	5.66	5.70	5.61
Totals	13.29	13.40	13.50	13.56	13.44

1 Auto	18.48	18.67	18.88	191.03	18.77
2 Motorcycle	49.49	49.93	51.25	51.43	50.52
3 Bus	7.15	7.23	7.31	7.40	7.27
4 Pickup/Van	13.34	13.50	13.64	13.74	13.56
5 SU Truck	6.05	6.10	6.16	6.20	6.13
6 CU Truck	5.48	5.52	5.62	5.65	5.57
Totals	13.29	13.40	13.50	13.56	13.44

1 Pass Vehicles	18.60	18.80	19.04	19.18	18.91
2 Trucks	5.88	5.93	6.00	6.04	5.96
Totals	13.29	13.40	13.50	13.56	13.44

TABLE 7

ANNUAL GASOLINE CONSUMPTION
ALL VEHICLE CLASSES

VEHICLE TYPE	1985 CON. GASOLINE MOTOR FUEL GALS. (000)	1986 CON. GASOLINE MOTOR FUEL GALS. (000)	1987 OAE GASOLINE MOTOR FUEL GALS. (000)	1988 OAE GASOLINE MOTOR FUEL GALS. (000)	1985-88 GASOLINE MOTOR FUEL GALS. (000)	1985-88 GASOLINE MOTOR FUEL GALS. PERCENT
1 Standard Auto	395,840	361,769	345,094	332,510	1,435,213	43.40%
2 Small Auto	114,600	115,316	120,244	126,437	476,596	14.41
3 Motorcycle	2,765	2,655	2,558	2,592	10,570	0.32
4 Intercity Bus	0	0	0	0	0	0.00
5 Transit Bus	0	0	0	0	0	0.00
6 School Bus	5,793	5,525	5,261	5,295	21,874	0.66
7 SU-4T <6	0	0	0	0	0	0.00
8 SU-4T 6-10	0	0	0	0	0	0.00
9 SU-4T >10	270,168	258,126	257,549	259,353	1,045,197	31.60
10 SU-6T <19.5	21,223	20,252	19,401	19,535	80,411	2.43
11 SU-6T 19.5-26	27,128	27,897	24,817	24,998	102,840	3.11
12 SU-6T >26	7,857	7,819	7,930	8,283	31,890	0.96
13 SU-3AX <26	473	451	429	432	1,785	0.05
14 SU-3AX 26-33	1,604	1,593	1,575	1,646	6,419	0.19
15 SU-3AX 33-40	1,153	1,146	1,133	1,184	4,616	0.14
16 SU-3AX 40-50	7,608	7,559	7,497	7,835	30,499	0.92
17 SU-3AX >50	0	0	0	0	0	0.00
18 CU-3AX <26	0	0	0	0	0	0.00
19 CU-3AX 26-50	2,360	2,347	2,371	2,475	9,553	0.29
20 CU-3AX >50	53	52	53	55	213	0.01
21 CU-2S2 <50	548	545	547	572	2,212	0.07
22 CU-2S2 50-60	2,335	2,323	2,348	2,453	9,460	0.29
23 CU-2S2 >60	34	33	34	35	136	0.00
24 CU-4AX <50	73	72	72	76	293	0.01
25 CU-4AX 50-60	194	193	194	202	783	0.02
26 CU-4AX >60	4	4	4	4	15	0.00
27 CU-3S2 <50	7	7	7	7	28	0.00
28 CU-3S2 50-70	363	359	359	375	1,455	0.04
29 CU-3S2 70-75	1,638	1,629	1,628	1,702	6,597	0.20
30 CU-3S2 >75	6,346	6,314	6,336	6,624	25,620	0.77
31 CU-5AX <50	0	0	0	0	0	0.00
32 CU-5AX 50-70	21	21	22	22	87	0.00
33 CU-5AX 70-75	102	101	101	106	410	0.01
34 CU-5AX >75	375	373	372	389	1,509	0.05
35 CU-6+AX <50	0	0	0	0	0	0.00
36 CU-6+AX 50-70	12	12	12	13	50	0.00
37 CU-6+AX 70-75	49	49	48	51	197	0.01
38 CU-6+AX >75	185	184	185	193	747	0.02
Totals	870,909	822,727	808,182	805,455	3,307,273	100.00%

TABLE 8

ANNUAL GASOLINE CONSUMPTION
COMBINED VEHICLE CLASSES

VEHICLE TYPE	1985 CON. GASOLINE MOTOR FUEL GALS. (000)	1986 CON. GASOLINE MOTOR FUEL GALS. (000)	1987 OAE GASOLINE MOTOR FUEL GALS. (000)	1988 OAE GASOLINE MOTOR FUEL GALS. (000)	1985-88 GASOLINE MOTOR FUEL GALS. (000)	1985-88 GASOLINE MOTOR FUEL GALS. PERCENT
1 Standard Auto	395,840	361,769	345,094	332,510	1,435,213	43.40%
2 Small Auto	114,600	115,316	120,244	126,437	476,596	14.41
3 Motorcycle	2,765	2,655	2,558	2,592	10,570	0.32
4 Intercity Bus	0	0	0	0	0	0.00
5 Other Bus	5,793	5,525	5,261	5,295	21,874	0.66
6 Pickup/Van	270,168	258,126	257,549	259,353	1,045,197	31.60
7 SU Truck <26	48,823	46,600	44,647	44,965	185,035	5.59
8 SU Truck >26	18,223	18,117	18,135	18,949	73,424	2.22
9 CU Truck <50	2,988	2,971	2,997	3,130	12,085	0.37
10 CU Truck 50-70	3,015	2,999	3,025	3,160	12,199	0.37
11 CU Truck 70-75	1,789	1,779	1,778	1,858	7,203	0.22
12 CU Truck >75	6,906	6,870	6,894	7,206	27,876	0.84
Totals	870,909	822,727	808,182	805,455	3,307,273	100.00%

1 Auto	510,440	477,085	465,338	458,947	1,911,809	57.81%
2 Motorcycle	2,765	2,655	,2558	2,592	10,570	0.32
3 Bus	5,793	5,525	5,261	5,295	21,874	0.66
4 Pickup/Van	270,168	258,126	257,549	259,353	1,045,197	31.60
5 SU Truck	67,046	64,717	62,783	63,914	258,460	7.81
6 CU Truck	14,698	14,619	14,693	15,354	59,363	1.79
Totals	870,909	822,727	808,182	805,455	3,307,273	100.00%

1 Pass Vehicles	789,165	743,391	730,706	726,187	2,989,450	90.39%
2 Trucks	81,744	79,336	77,476	79,268	317,823	9.61
Totals	870,909	822,727	808,182	805,455	3,307,273	100.00%

TABLE 9

ANNUAL GASOHOL CONSUMPTION
ALL VEHICLE CLASSES

VEHICLE TYPE	1985 CON. GASOHOL MOTOR FUEL GALS. (000)	1986 CON. GASOHOL MOTOR FUEL GALS. (000)	1987 OAE GASOHOL MOTOR FUEL GALS. (000)	1988 OAE GASOHOL MOTOR FUEL GALS. (000)	1985-88 GASOHOL MOTOR FUEL GALS. (000)	1985-88 GASOHOL MOTOR FUEL GALS. PERCENT
1 Standard Auto	121,204	139,244	136,640	131,415	528,503	43.26%
2 Small Auto	35,090	44,385	47,611	49,971	177,056	14.49
3 Motorcycle	847	1,022	1,013	1,024	3,906	0.32
4 Intercity Bus	0	0	0	0	0	0.00
5 Transit Bus	0	0	0	0	0	0.00
6 School Bus	1,774	2,127	2,083	2,093	8,076	0.66
7 SU-4T <6	0	0	0	0	0	0.00
8 SU-4T 6-10	0	0	0	0	0	0.00
9 SU-4T >10	82,724	99,352	101,977	102,502	386,555	31.64
10 SU-6T <19.5	6,498	7,795	7,682	7,721	29,696	2.43
11 SU-6T 19.5-26	8,306	9,968	9,826	9,880	37,980	3.11
12 SU-6T >26	2,406	3,010	3,140	3,274	11,829	0.97
13 SU-3AX <26	145	174	170	171	659	0.05
14 SU-3AX 26-33	491	613	624	651	2,379	0.19
15 SU-3AX 33-40	353	441	449	468	1,711	0.14
16 SU-3AX 40-50	2,330	2,909	2,969	3,096	11,304	0.93
17 SU-3AX >50	0	0	0	0	0	0.00
18 CU-3AX <26	0	0	0	0	0	0.00
19 CU-3AX 26-50	723	903	939	978	3,543	0.29
20 CU-3AX >50	16	20	21	22	79	0.01
21 CU-2S2 <50	168	210	217	226	820	0.07
22 CU-2S2 50-60	715	894	930	970	3,509	0.29
23 CU-2S2 >60	10	13	13	14	50	0.00
24 CU-4AX <50	22	28	29	30	108	0.01
25 CU-4AX 50-60	59	74	77	80	290	0.02
26 CU-4AX >60	1	1	2	2	6	0.00
27 CU-3S2 <50	2	3	3	3	10	0.00
28 CU-3S2 50-70	111	138	142	148	539	0.04
29 CU-3S2 70-75	502	627	645	673	2,446	0.20
30 CU-3S2 >75	1,943	2,430	2,509	2,618	9,500	0.78
31 CU-5AX <50	0	0	0	0	0	0.00
32 CU-5AX 50-70	7	8	9	9	32	0.00
33 CU-5AX 70-75	31	39	40	42	152	0.01
34 CU-5AX >75	115	143	147	154	559	0.05
35 CU-6+AX <50	0	0	0	0	0	0.00
36 CU-6+AX 50-70	4	5	5	5	18	0.00
37 CU-6+AX 70-75	15	19	19	20	73	0.01
38 CU-6+AX >75	57	71	73	76	277	0.02
Totals	266,667	316,667	320,000	318,333	1,221,667	100.00%

TABLE 10

ANNUAL GASOHOL CONSUMPTION
COMBINED VEHICLE CLASSES

	VEHICLE TYPE	1985 CON. GASOHOL MOTOR FUEL GALS. (000)	1986 CON. GASOHOL MOTOR FUEL GALS. (000)	1987 OAE GASOHOL MOTOR FUEL GALS. (000)	1988 OAE GASOHOL MOTOR FUEL GALS. (000)	1985-88 GASOHOL MOTOR FUEL GALS. (000)	1985-88 GASOHOL MOTOR FUEL GALS. PERCENT
1	Standard Auto	121,204	139,244	136,640	131,415	528,503	43.26%
2	Small Auto	35,090	44,385	47,611	49,971	177,056	14.49
3	Motorcycle	847	1,022	1,013	1,024	3,906	0.32
4	Intercity Bus	0	0	0	0	0	0.00
5	Other Bus	1,774	2,127	2,083	2,093	8,076	0.66
6	Pickup/Van	82,724	99,352	101,977	102,502	386,555	31.64
7	SU Truck <26	14,949	17,936	17,678	17,771	68,335	5.59
8	SU Truck >26	5,580	6,973	7,181	7,489	27,223	2.23
9	CU Truck <50	915	1,144	1,187	1,237	4,482	0.37
10	CU Truck 50-70	923	1,154	1,198	1,249	4,524	0.37
11	CU Truck 70-75	548	685	704	734	2,671	0.22
12	CU Truck >75	2,115	2,644	2,730	2,848	10,337	0.85
	Totals	266,667	316,667	320,000	318,333	1,221,667	100.00%
1	Auto	156,293	183,629	184,251	181,386	705,559	57.75%
2	Motorcycle	847	1,022	1,013	1,024	3,906	0.32
3	Bus	1,774	2,127	2,083	2,093	8,076	0.66
4	Pickup/Van	82,724	99,352	101,977	102,502	386,555	31.64
5	SU Truck	20,529	24,910	24,859	25,260	95,558	7.82
6	CU Truck	4,500	5,627	5,818	6,068	22,013	1.80
	Totals	266,667	316,667	320,000	318,333	1,221,667	100.00%
1	Pass Vehicles	241,637	286,130	289,323	287,005	1,104,096	90.38%
2	Trucks	25,029	39,536	30,677	31,328	117,571	9.62
	Totals	266,667	316,667	320,000	318,333	1,221,667	100.00%

TABLE 11

ANNUAL DIESEL CONSUMPTION
ALL VEHICLE CLASSES

VEHICLE TYPE	1985 CON. DIESEL MOTOR FUEL GALS. (000)	1986 CON. DIESEL MOTOR FUEL GALS. (000)	1987 OAE DIESEL MOTOR FUEL GALS. (000)	1988 OAE DIESEL MOTOR FUEL GALS. (000)	1985-88 DIESEL MOTOR FUEL GALS. (000)	1985-88 DIESEL MOTOR FUEL GALS. PERCENT
1 Standard Auto	3,713	3,607	3,674	3,568	14,562	1.29%
2 Small Auto	1,487	1,591	1,771	1,877	6,727	0.59
3 Motorcycle	0	0	0	0	0	0.00
4 Intercity Bus	1,926	1,953	1,985	2,015	7,879	0.70
5 Transit Bus	1,384	1,420	1,454	1,491	5,750	0.51
6 School Bus	0	0	0	0	0	0.00
7 SU-4T <6	0	0	0	0	0	0.00
8 SU-4T 6-10	0	0	0	0	0	0.00
9 SU-4T >10	2,648	2,689	2,866	2,908	11,112	0.98
10 SU-6T <19.5	4,456	4,520	4,623	4,692	18,291	1.61
11 SU-6T 19.5-26	6,654	6,752	6,909	7,015	27,329	2.41
12 SU-6T >26	4,311	4,560	4,939	5,199	19,008	1.68
13 SU-3AX <26	660	669	680	690	2,699	0.24
14 SU-3AX 26-33	2,546	2,688	2,838	2,990	11,061	0.98
15 SU-3AX 33-40	2,633	2,781	2,936	3,093	11,443	1.01
16 SU-3AX 40-50	19,204	20,281	21,480	22,624	83,590	7.38
17 SU-3AX >50	0	0	0	0	0	0.00
18 CU-3AX <26	0	0	0	0	0	0.00
19 CU-3AX 26-50	10,922	11,544	12,452	13,104	48,022	4.24
20 CU-3AX >50	354	375	402	423	1,554	0.14
21 CU-2S2 <50	2,911	3,077	3,296	3,472	12,757	1.13
22 CU-2S2 50-60	17,895	18,927	20,427	21,510	78,759	6.95
23 CU-2S2 >60	452	478	515	542	1,987	0.18
24 CU-4AX <50	244	258	277	291	1,070	0.09
25 CU-4AX 50-60	1,671	1,766	1,891	1,991	7,319	0.65
26 CU-4AX >60	47	50	54	56	207	0.02
27 CU-3S2 <50	112	119	128	134	493	0.04
28 CU-3S2 50-70	6,582	6,957	7,426	7,823	28,788	2.54
29 CU-3S2 70-75	30,583	32,321	34,499	36,338	133,741	11.80
30 CU-3S2 >75	122,383	129,437	138,711	146,152	536,683	47.37
31 CU-5AX <50	7	7	8	8	30	0.00
32 CU-5AX 50-70	395	418	451	474	1,737	0.15
33 CU-5AX 70-75	1,915	2,023	2,167	2,281	8,387	0.74
34 CU-5AX >75	7,208	7,613	8,122	8,550	31,492	2.78
35 CU-6+AX <50	3	3	4	4	14	0.00
36 CU-6+AX 50-70	194	205	222	233	854	0.08
37 CU-6+AX 70-75	899	951	1,012	1,066	3,928	0.35
38 CU-6+AX >75	3,601	3,806	4,091	4,306	15,804	1.39
Totals	260,000	273,846	292,308	306,923	1,133,077	100.00%

TABLE 12

ANNUAL DIESEL CONSUMPTION
COMBINED VEHICLE CLASSES

VEHICLE TYPE	1985 CON. DIESEL MOTOR FUEL GALS. (000)	1986 CON. DIESEL MOTOR FUEL GALS. (000)	1987 OAE DIESEL MOTOR FUEL GALS. (000)	1988 OAE DIESEL MOTOR FUEL GALS. (000)	1985-88 DIESEL MOTOR FUEL GALS. (000)	1985-88 DIESEL MOTOR FUEL GALS. PERCENT
1 Standard Auto	3,713	3,607	3,674	3,568	14,562	1.29%
2 Small Auto	1,487	1,591	1,771	1,877	6,727	0.59
3 Motorcycle	0	0	0	0	0	0.00
4 Intercity Bus	1,926	1,953	1,985	2,015	7,879	0.70
5 Other Bus	1,384	1,420	1,454	1,491	5,750	0.51
6 Pickup/Van	2,648	2,689	2,866	2,908	11,112	0.98
7 SU Truck <26	11,769	11,940	12,213	12,397	48,319	4.26
8 SU Truck >26	28,693	30,310	32,193	33,906	125,103	11.04
9 CU Truck <50	14,200	15,009	16,164	17,013	62,385	5.51
10 CU Truck 50-70	27,591	29,175	31,386	33,053	121,205	10.70
11 CU Truck 70-75	33,397	35,295	37,678	39,686	146,055	12.89
12 CU Truck >75	133,192	140,856	150,925	159,008	583,980	51.54
Totals	260,000	273,846	292,308	306,923	1,133,077	100.00%
1 Auto	5,200	5,198	5,445	5,445	21,289	1.88
2 Motorcycle	0	0	0	0	0	0.00
3 Bus	3,310	3,373	3,439	3,506	13,629	1.20
4 Pickup/Van	2,648	2,689	2,866	2,908	11,112	0.98
5 SU Truck	40,463	42,250	44,406	46,303	173,422	15.31
6 CU Truck	208,379	220,335	236,152	248,760	913,626	80.63
Totals	260,000	273,846	292,308	306,923	1,133,077	100.00%
1 Pass Vehicles	11,158	11,261	11,750	11,860	46,029	4.06%
2 Trucks	248,842	262,586	280,558	295,063	1,087,048	95.94
Totals	260,000	273,846	292,308	306,923	1,133,077	100.00%

TABLE 13

ANNUAL LP GAS CONSUMPTION
ALL VEHICLE CLASSES

VEHICLE TYPE	1985 CON. LP GAS MOTOR FUEL GALS. (000)	1986 CON. LP GAS MOTOR FUEL GALS. (000)	1987 OAE LP GAS MOTOR FUEL GALS. (000)	1988 OAE LP GAS MOTOR FUEL GALS. (000)	1985-88 LP GAS MOTOR FUEL GALS. (000)	1985-88 LP GAS MOTOR FUEL GALS. PERCENT
1 Standard Auto	2,533	2,432	2,373	2,277	9,615	26.71%
2 Small Auto	736	778	829	868	3,211	8.92
3 Motorcycle	0	0	0	0	0	0.00
4 Intercity Bus	0	0	0	0	0	0.00
5 Transit Bus	0	0	0	0	0	0.00
6 School Bus	0	0	0	0	0	0.00
7 SU-4T <6	0	0	0	0	0	0.00
8 SU-4T 6-10	0	0	0	0	0	0.00
9 SU-4T >10	1,706	1,712	1,747	1,752	6,917	19.21
10 SU-6T <19.5	1,318	1,321	1,294	1,298	5,232	14.53
11 SU-6T 19.5-26	1,720	1,725	1,691	1,696	6,833	18.98
12 SU-6T >26	585	611	634	659	2,489	6.91
13 SU-3AX <26	0	0	0	0	0	0.00
14 SU-3AX 26-33	0	0	0	0	0	0.00
15 SU-3AX 33-40	0	0	0	0	0	0.00
16 SU-3AX 40-50	0	0	0	0	0	0.00
17 SU-3AX >50	0	0	0	0	0	0.00
18 CU-3AX <26	0	0	0	0	0	0.00
19 CU-3AX 26-50	158	165	170	177	671	1.86
20 CU-3AX >50	0	0	0	0	0	0.00
21 CU-2S2 <50	0	0	0	0	0	0.00
22 CU-2S2 50-60	0	0	0	0	0	0.00
23 CU-2S2 >60	0	0	0	0	0	0.00
24 CU-4AX <50	0	0	0	0	0	0.00
25 CU-4AX 50-60	0	0	0	0	0	0.00
26 CU-4AX >60	0	0	0	0	0	0.00
27 CU-3S2 <50	0	0	0	0	0	0.00
28 CU-3S2 50-70	10	10	10	11	41	0.11
29 CU-3S2 70-75	43	45	46	48	182	0.51
30 CU-3S2 >75	171	179	184	191	726	2.02
31 CU-5AX <50	0	0	0	0	0	0.00
32 CU-5AX 50-70	0	0	0	0	0	0.00
33 CU-5AX 70-75	3	3	3	3	12	0.03
34 CU-5AX >75	10	11	11	11	43	0.12
35 CU-6+AX <50	0	0	0	0	0	0.00
36 CU-6+AX 50-70	0	0	0	0	0	0.00
37 CU-6+AX 70-75	1	1	1	2	6	0.02
38 CU-6+AX >75	5	6	6	6	23	0.06
Totals	9,000	9,000	9,000	9,000	36,000	100.00%

TABLE 14

ANNUAL LP GAS CONSUMPTION
COMBINED VEHICLE CLASSES

VEHICLE TYPE	1985 CON. LP GAS MOTOR FUEL GALS. (000)	1986 CON. LP GAS MOTOR FUEL GALS. (000)	1987 OAE LP GAS MOTOR FUEL GALS. (000)	1988 OAE LP GAS MOTOR FUEL GALS. (000)	1985-88 LP GAS MOTOR FUEL GALS. (000)	1985-88 LP GAS MOTOR FUEL GALS. PERCENT
1 Standard Auto	2,533	2,432	2,373	2,277	9,615	26.71%
2 Small Auto	736	778	829	868	3,211	8.92
3 Motorcycle	0	0	0	0	0	0.00
4 Intercity Bus	0	0	0	0	0	0.00
5 Other Bus	0	0	0	0	0	0.00
6 Pickup/Van	1,706	1,712	1,747	1,752	6,916	19.21
7 SU Truck <26	3,039	3,047	2,985	2,994	12,065	33.51
8 SU Truck >26	585	611	634	659	2,489	6.91
9 CU Truck <50	158	165	170	177	671	1.86
10 CU Truck 50-70	10	10	10	11	41	0.11
11 CU Truck 70-75	47	49	51	53	200	0.55
12 CU Truck >75	187	196	201	209	792	2.20
Totals	9,000	9,000	9,000	9,000	36,000	100.00%
1 Auto	3,269	3,210	3,202	3,145	12,825	35.63
2 Motorcycle	0	0	0	0	0	0.00
3 Bus	0	0	0	0	0	0.00
4 Pickup/Van	1,706	1,712	1,747	1,752	6,916	19.21
5 SU Truck	3,623	3,658	3,619	3,654	14,554	40.43
6 CU Truck	402	420	432	449	1,704	4.73
Totals	9,000	9,000	9,000	9,000	36,000	100.00%
1 Pass Vehicles	4,975	4,922	4,949	4,897	19,743	54.84%
2 Trucks	4,025	4,078	4,051	4,103	16,257	45.16
Totals	9,000	9,000	9,000	9,000	36,000	100.00%

TABLE 15

ANNUAL FUEL CONSUMPTION
ALL VEHICLE CLASSES

VEHICLE TYPE	1985 CON. COMBINED MOTOR FUEL GALS. (000)	1986 COMBINED MOTOR FUEL GALS. (000)	1987 COMBINED MOTOR FUEL GALS. (000)	1988 COMBINED MOTOR FUEL GALS. (000)	1985-88 COMBINED MOTOR FUEL GALS. (000)	1985-88 COMBINED MOTOR FUEL GALS. PERCENT
1 Standard Auto	523,290	507,052	487,781	469,770	1,987,893	34.89%
2 Small Auto	151,913	162,069	170,455	179,153	663,589	11.65
3 Motorcycle	3,612	3,678	3,571	3,616	14,476	0.25
4 Intercity Bus	1,926	1,953	1,985	2,015	7,879	0.14
5 Transit Bus	1,384	1,420	1,454	1,491	5,750	0.10
6 School Bus	7,566	7,651	7,345	7,388	29,950	0.53
7 SU-4T <6	0	0	0	0	0	0.00
8 SU-4T 6-10	0	0	0	0	0	0.00
9 SU-4T >10	357,245	361,880	364,139	366,516	1,449,781	25.44
10 SU-6T <19.5	33,495	33,888	33,001	33,246	133,629	2.35
11 SU-6T 19.5-26	43,808	44,341	43,244	43,589	174,982	3.07
12 SU-6T >26	15,158	16,000	16,642	17,416	65,216	1.14
13 SU-3AX <26	1,277	1,294	1,279	1,293	5,143	0.09
14 SU-3AX 26-33	4,641	4,894	5,038	5,287	19,859	0.35
15 SU-3AX 33-40	4,140	4,368	4,517	4,745	17,770	0.31
16 SU-3AX 40-50	29,142	30,750	31,946	33,555	125,393	2.20
17 SU-3AX >50	0	0	0	0	0	0.00
18 CU-3AX <26	0	0	0	0	0	0.00
19 CU-3AX 26-50	14,163	14,959	15,932	16,735	61,788	1.08
20 CU-3AX >50	423	447	475	500	1,846	0.03
21 CU-2S2 <50	3,627	3,833	4,060	4,269	15,789	0.28
22 CU-2S2 50-60	20,945	22,145	23,705	24,933	91,727	1.61
23 CU-2S2 >60	496	524	562	591	2,173	0.04
24 CU-4AX <50	339	358	377	397	1,471	0.03
25 CU-4AX 50-60	1,924	2,033	2,161	2,274	8,392	0.15
26 CU-4AX >60	52	55	59	62	228	0.00
27 CU-3S2 <50	121	128	137	144	531	0.01
28 CU-3S2 50-70	7,066	7,464	7,937	8,356	30,824	0.54
29 CU-3S2 70-75	32,766	34,622	36,818	38,760	142,967	2.51
30 CU-3S2 >75	130,844	138,360	147,740	155,585	572,529	10.05
31 CU-5AX <50	7	7	8	8	30	0.00
32 CU-5AX 50-70	423	447	481	506	1,856	0.03
33 CU-5AX 70-75	2,051	2,166	2,311	2,432	8,960	0.16
34 CU-5AX >75	7,708	8,140	8,652	9,104	33,604	0.59
35 CU-6+AX <50	3	3	4	4	14	0.00
36 CU-6+AX 50-70	210	222	239	251	922	0.02
37 CU-6+AX 70-75	964	1,019	1,081	1,139	4,203	0.07
38 CU-6+AX >75	3,848	4,067	4,355	4,582	16,852	0.30
Totals	1,406,576	1,422,240	1,429,490	1,439,711	5,698,016	100.00%

TABLE 16

ANNUAL FUEL CONSUMPTION
COMBINATION VEHICLE CLASSES

VEHICLE TYPE	1985 CON. COMBINED MOTOR FUEL GALS. (000)	1986 COMBINED MOTOR FUEL GALS. (000)	1987 COMBINED MOTOR FUEL GALS. (000)	1988 COMBINED MOTOR FUEL GALS. (000)	1985-88 COMBINED MOTOR FUEL GALS. (000)	1985-88 COMBINED MOTOR FUEL GALS. PERCENT
1 Standard Auto	523,290	507,052	487,781	469,770	1,987,893	34.89%
2 Small Auto	151,913	162,069	170,455	179,153	663,589	11.65
3 Motorcycle	3,612	3,678	3,571	3,616	14,476	0.25
4 Intercity Bus	1,926	1,953	1,985	2,015	7,879	0.14
5 Other Bus	8,951	9,071	8,798	8,879	35,700	0.63
6 Pickup/Van	357,245	361,880	364,139	366,516	1,449,781	25.44
7 SU Truck <26	78,580	79,523	77,524	78,127	313,755	5.51
8 SU Truck >26	53,080	56,012	58,143	61,003	228,238	4.01
9 CU Truck <50	18,260	19,288	20,517	21,557	79,623	1.40
10 CU Truck 50-70	31,539	33,338	35,169	37,472	137,968	2.42
11 CU Truck 70-75	35,781	37,808	40,210	42,330	156,129	2.74
12 CU Truck >75	142,400	150,566	160,748	169,272	622,985	10.93
Totals	1,406,576	1,422,240	1,429,490	1,439,711	5,698,016	100.00%
1 Auto	675,202	669,121	658,236	648,923	2,651,482	46.53%
2 Motorcycle	3,612	3,678	3,571	3,616	14,476	0.25
3 Bus	10,876	11,025	10,784	10,894	43,579	0.76
4 Pickup/Van	357,245	361,880	364,139	366,516	1,449,781	25.44
5 SU Truck	131,660	135,535	135,667	139,130	541,993	9.51
6 CU Truck	227,980	241,001	257,094	270,631	996,706	17.49
Totals	1,406,576	1,422,240	1,429,490	1,439,711	5,698,016	100.00%
1 Pass Vehicles	1,046,936	1,045,704	1,036,729	1,029,949	4,159,318	73.00%
2 Trucks	359,640	376,536	392,761	409,762	1,538,698	27.00
Totals	1,406,576	1,422,240	1,429,490	1,439,711	5,698,016	100.00%

TABLE 17

1985-88 MOTOR FUEL TAXES
ALL VEHICLE CLASSES

	VEHICLE TYPE	1985-88 GASOLINE MOTOR FUEL TAX ($000)	1985-88 GASOHOL MOTOR FUEL TAX ($000)	1985-88 DIESEL MOTOR FUEL TAX ($000)	1985-88 LP GAS MOTOR FUEL TAX ($000)	1985-88 TOTAL MOTOR FUEL TAX ($000)	1985-88 TOTAL MOTOR FUEL TAX PERCENT	1985-88 ANNUAL MOTOR FUEL TAX PER VEHICLE ($)	1985-88 UNIT MOTOR FUEL TAX PER VMT ($)
1	Standard Auto	157,873	31,710	1,893	961	192,438	32.73%	66	0.006
2	Small Auto	52,426	10,623	874	321	64,244	10.93	40	0.004
3	Motorcycle	1,163	234	0	0	1,397	0.24	4	0.002
4	Intercity Bus	0	0	1,024	0	1,024	0.17	1,225	0.022
5	Transit Bus	0	0	747	0	747	0.13	1,106	0.034
6	School Bus	2,406	485	0	0	2,891	0.49	100	0.013
7	SU-4T <6	0	0	0	0	0	0.00	0	0.000
8	SU-4T 6-10	0	0	0	0	0	0.00	0	0.000
9	SU-4T >10	114,972	23,193	1,444	692	140,301	23.86	82	0.007
10	SU-6T <19.5	8,845	1,782	2,378	523	13,528	2.30	177	0.015
11	SU-6T 19.5-26	11,312	2,279	3,553	683	17,827	3.03	196	0.016
12	SU-6T >26	3,508	710	2,471	249	6,938	1.18	251	0.019
13	SU-3AX <26	196	40	351	0	587	0.10	232	0.018
14	SU-3AX 26-33	706	143	1,438	0	2,287	0.39	257	0.020
15	SU-3AX 33-40	508	103	1,488	0	2,098	0.36	344	0.022
16	SU-3AX 40-50	3,355	678	10,867	0	14,900	2.53	378	0.024
17	SU-3AX >50	0	0	0	0	0	0.00	0	0.000
18	CU-3AX <26	0	0	0	0	0	0.00	0	0.000
19	CU-3AX 26-50	1,051	213	6,243	67	7,573	1.29	481	0.023
20	CU-3AX >50	23	5	202	0	230	0.04	559	0.022
21	CU-2S2 <50	243	49	1,658	0	1,951	0.33	603	0.022
22	CU-2S2 50-60	1,041	211	10,239	0	11,490	1.95	820	0.023
23	CU-2S2 >60	15	3	258	0	276	0.05	1,031	0.023
24	CU-4AX <50	32	7	139	0	178	0.03	529	0.021
25	CU-4AX 50-60	86	17	951	0	1,055	0.18	762	0.023
26	CU-4AX >60	2	0	27	0	29	0.00	1,204	0.025
27	CU-3S2 <50	3	1	64	0	68	0.01	1,129	0.023
28	CU-3S2 50-70	160	32	3,742	4	3,939	0.67	1,103	0.023
29	CU-3S2 70-75	726	147	17,386	18	18,277	3.11	1,458	0.023
30	CU-3S2 >75	2,818	570	69,769	73	73,230	12.45	1,574	0.023
31	CU-5AX <50	0	0	4	0	4	0.00	885	0.023
32	CU-5AX 50-70	10	2	226	0	237	0.04	885	0.023
33	CU-5AX 70-75	45	9	1,090	1	1,146	0.19	1,332	0.024
34	CU-5AX >75	166	34	4,094	4	4,298	0.73	1,454	0.023
35	CU-6+AX <50	0	0	2	0	2	0.00	441	0.024
36	CU-6+AX 50-70	5	1	111	0	118	0.02	840	0.025
37	CU-6+AX 70-75	22	4	511	1	537	0.09	1,138	0.023
38	CU-6+AX >75	82	17	2,055	2	2,156	0.37	1,553	0.023
	Totals	363,800	73,300	147,300	3,600	588,000	100.00%	85	0.008

TABLE 18

1985-88 MOTOR FUEL TAXES
COMBINED VEHICLE CLASSES

	VEHICLE TYPE	1985-88 GASOLINE MOTOR FUEL TAX ($000)	1985-88 GASOHOL MOTOR FUEL TAX ($000)	1985-88 DIESEL MOTOR FUEL TAX ($000)	1985-88 LP GAS MOTOR FUEL TAX ($000)	1985-88 TOTAL MOTOR FUEL TAX ($000)	1985-88 TOTAL MOTOR FUEL TAX PERCENT	1985-88 ANNUAL MOTOR FUEL TAX PER VEHICLE ($)	1985-88 UNIT MOTOR FUEL TAX PER VMT ($)
1	Standard Auto	157,873	31,710	1,893	961	192,438	32.73%	66	0.006
2	Small Auto	52,426	10,623	874	321	64,244	10.93	40	0.004
3	Motorcycle	1,163	234	0	0	1,397	0.24	4	0.002
4	Intercity Bus	0	0	1,024	0	1,024	0.17	1,225	0.022
5	Other Bus	2,406	485	747	0	3,638	0.62	123	0.015
6	Pickup/Van	114,972	23,193	1,444	692	140,301	23.86	82	0.007
7	SU Truck <26	20,354	4,100	6,282	1,206	31,942	5.43	188	0.016
8	SU Truck >26	8,007	1,633	16,263	249	26,222	4.46	320	0.022
9	CU Truck <50	1,329	269	8,110	67	9,775	1.66	504	0.022
10	CU Truck 50-70	1,342	271	15,757	4	17,374	2.95	865	0.023
11	CU Truck 70-75	792	160	18,987	20	19,960	3.39	1,440	0.023
12	CU Truck >75	3,066	620	75,917	79	79,683	13.55	1,566	0.023
	Totals	363,800	73,300	147,300	3,600	588,000	100.00%	85	0.008

	VEHICLE TYPE	1985-88 GASOLINE MOTOR FUEL TAX ($000)	1985-88 GASOHOL MOTOR FUEL TAX ($000)	1985-88 DIESEL MOTOR FUEL TAX ($000)	1985-88 LP GAS MOTOR FUEL TAX ($000)	1985-88 TOTAL MOTOR FUEL TAX ($000)	1985-88 TOTAL MOTOR FUEL TAX PERCENT	1985-88 ANNUAL MOTOR FUEL TAX PER VEHICLE ($)	1985-88 UNIT MOTOR FUEL TAX PER VMT ($)
1	Auto	210,299	42,334	2,768	1,283	256,683	43.65%	57	0.005
2	Motorcycle	1,163	234	0	0	1,397	0.24	4	0.002
3	Bus	2,406	485	1,772	0	4,662	0.79	153	0.016
4	Pickup/Van	114,972	23,193	1,444	692	140,301	23.86	82	0.007
5	SU Truck	28,431	5,733	22,545	1,455	58,164	9.89	231	0.018
6	CU Truck	6,530	1,321	118,771	170	126,792	21.56	1,217	0.023
	Totals	363,800	73,300	147,300	3,600	588,000	100.00%	85	0.008

	VEHICLE TYPE	1985-88 GASOLINE MOTOR FUEL TAX ($000)	1985-88 GASOHOL MOTOR FUEL TAX ($000)	1985-88 DIESEL MOTOR FUEL TAX ($000)	1985-88 LP GAS MOTOR FUEL TAX ($000)	1985-88 TOTAL MOTOR FUEL TAX ($000)	1985-88 TOTAL MOTOR FUEL TAX PERCENT	1985-88 ANNUAL MOTOR FUEL TAX PER VEHICLE ($)	1985-88 UNIT MOTOR FUEL TAX PER VMT ($)
1	Pass Vehicles	328,839	66,246	5,984	1,974	403,043	68.54%	61	0.006
2	Trucks	34,961	7,054	141,316	1,626	184,957	31.46	520	0.021
	Totals	363,800	73,300	147,300	3,600	588,000	100.00%	85	0.027

ATTRIBUTION OF REGISTRATION REVENUES

The Federal Highway Administration (FHWA) vehicle types are based on combinations of vehicle types and registration groups. The Kansas weight registration groups are based on registration weight and use without consideration of axle weights and spacings. Roadway expenditures are allocated on the basis of FHWA vehicle types with revenues attributed on the basis of Kansas weight registration groups. In addition, the numbers of vehicles in the FHWA vehicle type groupings were developed from traffic counts and truck size and weight surveys and includes vehicles from other states. The numbers of vehicles in the Kansas weight registration groups represent Kansas registered vehicles only. The FHWA vehicle type numbers were used in the allocation of expenditures and the attribution of motor fuel taxes. Registration revenues generated from Kansas weight registration groups will be attributed to FHWA vehicle groups through iterations of the 1984 Vehicle Registration Distribution prepared by the Kansas Department of Revenue. The attribution amounts will be projected for the four year study period of 1985-1988 by the Policy and Analysis Branch of the Division of Planning and Development.

DISTRIBUTION OF 1984 KANSAS AUTOMOBILE REGISTRATIONS. Three data sources were utilized in attributing Kansas automobile registrations. The Federal Highway Administration vehicle types were obtained from traffic counts and includes vehicles from other states, shown in Table 19, FHWA AUTOMOBILE TYPES. The relative distribution of Kansas automobile registration weight group is shown in Table 20, 1983 KANSAS AUTOMOBILE REGISTRATION WEIGHT GROUPS. The actual 1984 automobile registrations, not listed by weight groups, are shown in Table 21, 1984 KANSAS AUTOMOBILE REGISTRATIONS. The 1984 Kansas automobile registrations were disaggregated using the following assumptions with the results listed in Table 22, DISAGGREGATION OF 1984 AUTOMOBILE REGISTRATIONS:

- FHWA and Kansas automobile numbers do not check because the FHWA numbers were obtained from samples of actual traffic including out of state traffic. Kansas registration numbers include multiple registrations.

- FHWA Vehicle Type 1, Standard Auto, with a GVW more than 2,800 pounds is equivalent to all Kansas autos with a GVW more than 3,000 pounds.

- FHWA Vehicle Type 2, Small Auto, with a GVW 2,800 pounds or less is equivalent to all Kansas autos with a GVW 3,000 pounds or less.

- The 1983 relative distribution of Kansas automobile registration weight groups is representative of the 1984 Kansas Automobile Registrations.

- The 1983 Kansas ratio of autos 3,000 pounds or less to autos with higher GVW also applies to antique, special interest, American Radio, and tax unit owned autos.

TABLE 19

FHWA AUTOMOBILE TYPES

FHWA VEHICLE TYPE	FHWA GVW	FHWA NUMBERS	FHWA PERCENT
1 Standard Auto	More than 2,800	729,600	64.67
2 Small Auto	2,800 or less	398,575	35.33
	Totals	1,128,175	100.00

TABLE 20

1983 KANSAS AUTOMOBILE REGISTRATION GROUPS

KANSAS VEHICLE TYPE	KANSAS GVW	KANSAS 1983 NUMBERS	KANSAS 1983 PERCENT
Automobile	3,000 or less	415,337	34.06
	3,001 to 3,999	555,996	45.60
	4,000 to 4,500	172,606	14.16
	more than 4,500	75,342	6.18
	Totals	1,219,281	100.00

TABLE 21

1984 KANSAS AUTOMOBILE REGISTRATIONS

KANSAS VEHICLE TYPE	KANSAS CLASS	KANSAS 1984 NUMBERS
Automobile	All Weight Groups	1,443,120
Automobile	Antique	2,434
Automobile	Special Interest	1,198
Automobile	American Radio	1,751
Automobile	Tax Unit Owned	5,815
	Totals	1,454,318

TABLE 22

DISAGGREGATION OF 1984 KANSAS AUTOMOBILE REGISTRATIONS

FHWA VEHICLE TYPE	FHWA NUMBERS	KANSAS VEHICLE TYPE	KANSAS GVW OR DESCRIPTION	KANSAS REGISTRATION APPLICATIONS
1 Standard Auto	729,600	Automobile	3,001 to 3,999	658,068
		Automobile	4,000 to 4,500	204,293
		Automobile	more than 4,500	89,173
		Automobile	Antique	1,605
		Automobile	Special Interest	790
		Automobile	American Radio	1,155
		Automobile	Tax Unit Owned	3,834
2 Small Auto	398,575	Automobile	3,000 or less	491,586
		Automobile	Antique	829
		Automobile	Special Interest	408
		Automobile	American Radio	596
		Automobile	Tax Unit Owned	1,981
Totals	1,129,175			1,454,318

DISTRIBUTION OF 1984 KANSAS MOTORCYCLE REGISTRATIONS. FHWA aggregates all motorcycles into one vehicle type, whereas Kansas registration types disaggregate motorcycles into several groups. Table 23, DISTRIBUTION OF 1984 MOTORCYCLE REGISTRATIONS, lists both the FHWA and Kansas motorcycle vehicle types. FHWA and Kansas motorcycle numbers do not check because the FHWA numbers were obtained from samples of actual traffic including out of state traffic. Kansas registration numbers include multiple registrations. In addition, a substantial number of motorcycle owners maintain current registration even though their use of the motorcycles is limited.

TABLE 23

DISTRIBUTION OF 1984 KANSAS MOTORCYCLE REGISTRATIONS

FHWA VEHICLE TYPE	FHWA NUMBERS	KANSAS VEHICLE TYPE	KANSAS GVW OR DESCRIPTION	KANSAS REGISTRATION APPLICATIONS
3 Motorcycle	80,221	Motorcycle		83,571
		Motor Bike		16,876
		Electric Vehicle		0
		Motorcycle	Tax Owned Unit	173
Totals	80,221			100,620

DISTRIBUTION OF 1984 KANSAS BUS REGISTRATIONS. FHWA identifies bus vehicle types by function whereas Kansas registrations utilize passenger capacity and ownership. The merging of the function/passenger capacity used the following assumptions:

- FHWA and Kansas bus numbers do not check because the FHWA numbers were obtained from samples of actual traffic including out of state traffic.

- All Intercity Buses have a capacity more than 39 passengers.

- Kansas transit buses are tax unit owned.

- A few school buses are owned by private contractors but most are tax unit owned.

Table 24, DISTRIBUTION OF 1984 BUS REGISTRATIONS, lists both FHWA and Kansas bus types.

TABLE 24

DISTRIBUTION OF 1984 KANSAS BUS REGISTRATIONS

FHWA VEHICLE TYPE	FHWA NUMBERS	KANSAS VEHICLE TYPE	KANSAS GVW OR DESCRIPTION	KANSAS REGISTRATION APPLICATIONS
4 Intercity Bus	209	Urban Bus	8 to 30 Pass.	0
		Urban Bus	31 to 39 Pass.	0
		Urban Bus	More than 39 Pass.	114
		Urban Bus	Tax Unit Owned	0
5 Transit Bus	169	Urban Bus	8 to 30 Pass.	0
		Urban Bus	31 to 39 Pass.	0
		Urban Bus	More than 39 Pass.	0
		Urban Bus	Tax Unit Owned	102
6 School Bus	7,253	Urban Bus	8 to 30 Pass.	41
		Urban Bus	31 to 39 Pass.	10
		Urban Bus	More than 39 Pass.	0
		Urban Bus	Tax Unit Owned	7,201
Totals	7,631			7,468

DISTRIBUTION OF 1984 KANSAS TRUCK REGISTRATIONS. FHWA truck types are based on combinations of vehicle types and registration groups. Kansas weight registration groups are based on registration weight and use without regard to axle weights and spacings. The FHWA truck population represents the actual truck population sorted by configuration and registration weights obtained from traffic counts and truck size and weight surveys and includes trucks registered in other states which are traveling in and through Kansas. The Kansas registered truck population was obtained from the 1984 Kansas Department of Revenue (KDOR)

Vehicle Registration Distribution and the Vehicle Registration Ledger which lists the trucks registered in the Regular, Local, 6,000 miles or less, Farm, and Tax Unit Owned categories. The Kansas registered truck population was distributed to FHWA truck types using the following assumptions:

- Kansas registered trucks have the same relative distribution of truck type and configuration as the FHWA truck population.
- Kansas registered trucks are assigned to FHWA truck types on the basis of the upper limit of the Kansas weight registration range.
- Kansas Tax Unit Owned trucks have the same relative distribution of weight registration groups as Kansas Regular trucks.
- All pickups and vans are registered in the 12,000 or less pounds weight group.
- All 6-Tired and larger vehicles are registered in the weight groups above 12,000 pounds.

The above assumptions were used to develop Table 25, MATRIX OF FHWA AND KANSAS TRUCK POPULATIONS. The matrix consists of cells in which FHWA vehicle types are listed in columns and Kansas weight registration groups in rows. Those cells in which both FHWA and Kansas trucks can exist are identified by an "X." Table 25 also contains the numbers of FHWA trucks by truck types and the numbers of Kansas trucks by use and weight registration groups. The Kansas truck population for each of the Kansas registration categories of Regular, Local, 6,000 miles or less, Farm, and Tax Unit Owned were distributed to FHWA vehicle types using a row-column iteration procedure. Tables 26 through 30 show the final distribution of Kansas registration categories and weight registration groups to FHWA vehicle types.

TABLE 25

MATRIX OF FHWA AND KANSAS TRUCK POPULATIONS

FHWA TRUCK TYPE	FHWA TRUCK NUMBERS	KANSAS WEIGHT REGISTRATION GROUPS															
		<12	12-16	16-20	20-24	24-30	30-36	36-42	42-48	48-54	54-60	60-66	66-74	74-80	80-85.5	24-54	>66
7 SU-4T <6	0	X															
8 SU-4T 6-10	0	X															
9 SU-4T >10	427,170	X															
10 SU-6T <19.5	19,087		X														
11 SU-6T 19.5-26	22,697			X	X												
12 SU-6T >26	6,917					X	X										
13 SU-3AX <26	632			X	X												
14 SU-3AX 26-33	2,224						X										
15 SU-AX 33-40	1,525							X									
16 SU-3AX 40-50	8,748							X	X								
17 SU-3AX >50	0									X						X	X
18 CU-3AX <26	0			X	X												
19 CU-3AX 26-50	3,938					X	X	X	X								
20 CU-3AX >50	103									X	X					X	X
21 CU-2S2 <50	809						X	X	X								
22 CU-2S2 50-60	3,505									X	X					X	
23 CU 2S2 >60	67											X	X				X
24 CU-4AX <50	84						X	X	X								
25 CU-4AX 50-60	364									X	X					X	
26 CU-4AX >60	6											X	X	X			X
27 CU-3S2 <50	15						X	X	X								
28 CU-3S2 50-70	893									X	X	X				X	X
29 CU-3S2 70-75	3,133												X				X
30 CU-3S2 >75	11,362													X	X		X
31 CU-5AX <50	1						X	X	X								
32 CU-5AX 50-70	67									X	X	X				X	X
33 CU-5AX 70-75	215												X				X
34 CU-5AX >75	739													X	X		X
35 CU-6+AX <50	1						X	X	X								
36 CU-6+AX 50-70	35									X	X	X				X	X
37 CU-6+AX 70-75	118												X				X
38 CU-6+AX >75	347													X	X		X
Total FHWA	514,784																
KANSAS TRUCK TYPES	**KANSAS TRUCK NUMBERS**																
Regular	438,617	408,688	6,350	4,432	6,114	3,854	1,568	1,126	1,477	1,313	664	304	410	1,313	1,004	0	0
Local	10,126	0	2,039	1,140	1,783	1,240	443	372	1,008	1,219	326	174	88	208	77	0	0
6,000	2,632	0	300	241	406	262	173	159	242	183	175	118	122	160	91	0	0
Farm	199,588	121,019	22,253	20,021	21,858	0	0	0	0	0	0	0	0	0	0	14,437	0
Tax Unit	8,661	8,070	125	88	121	76	31	22	29	26	13	6	8	26	20	0	0
Total Kansas	659,624	537,777	31,067	25,922	30,282	5,441	2,215	1,679	2,756	2,741	1,178	602	628	1,707	1,192	14,437	0

TABLE 26

DISTRIBUTION OF KANSAS 1984 REGULAR TRUCK WEIGHT REGISTRATION GROUPS BY FHWA TRUCK TYPES

FHWA TRUCK TYPE	FHWA TRUCK NUMBERS	KANSAS WEIGHT REGISTRATION GROUPS <12	12-16	16-20	20-24	24-30	30-36	36-42	42-48	48-54	54-60	60-66	66-74	74-80	80-85.5	24-54	>66	KANSAS TRUCK NUMBERS
7 SU-4T <6	0	0																0
8 SU-4T 6-10	0	0																0
9 SU-4T >10	427,170	391,464																391,464
10 SU-6T <19.5	19,087	17,224	6,350															23,574
11 SU-6T 19.5-26	22,697			4,312	5,948													10,260
12 SU-6T >26	6,917					2,783	588											3,371
13 SU-3AX <26	632			120	166													286
14 SU-3AX 26-33	2,224						654											654
15 SU-3AX 33-40	1,525							281										281
16 SU-3AX 40-50	8,748							698	1,220									1,918
17 SU-3AX >50	0									0						0	0	0
18 CU-3AX <26	0			0	0													0
19 CU-3AX 26-50	3,938					1,071	226	102	178									1,577
20 CU-3AX >50	103									28	14					0	0	42
21 CU-2S2 <50	809						89	40	70									199
22 CU-2S2 50-60	3,505									956	483					0		1,439
23 CU 2S2 >60	67											54	4				0	58
24 CU-4AX <50	84						9	4	7									20
25 CU-4AX 50-60	346									94	48					0		142
26 CU-4AX >60	6											2	0	1			0	3
27 CU-3S2 <50	15						2	1	1									4
28 CU-3S2 50-70	893									211	107	223				0	0	541
29 CU-3S2 70-75	3,133												366				0	366
30 CU-3S2 >75	11,362													1,198	916		0	2,144
31 CU-5AX <50	1						0	0	0									0
32 CU-5AX 50-70	67									16	8	17				0	0	41
33 CU-5AX 70-75	215												25				0	25
34 CU-5AX >75	739													78	60		0	138
35 CU-6+AX <50	1						0	0	0									0
36 CU-6+AX 50-70	35									8	4	9				0	0	21
37 CU-6+AX 70-75	118												14				0	14
38 CU-6+AX >75	347													37	28		0	65
Total FHWA	514,784	408,688	6,350	4,432	6,114	3,854	1,568	1,126	1,276	1,313	664	305	409	1,314	1,004	0	0	438,617

TABLE 27

DISTRIBUTION OF KANSAS 1984 LOCAL TRUCK WEIGHT REGISTRATION GROUPS BY FHWA TRUCK TYPES

FHWA TRUCK TYPE	FHWA TRUCK NUMBERS	KANSAS WEIGHT REGISTRATION GROUPS <12	12-16	16-20	20-24	24-30	30-36	36-42	42-48	48-54	54-60	60-66	66-74	74-80	80-85.5	24-54	>66	KANSAS TRUCK NUMBERS
7 SU-4T <6	0	0																0
8 SU-4T 6-10	0	0																0
9 SU-4T >10	427,170	0																0
10 SU-6T <19.5	19,087	0	2,039															2,039
11 SU-6T 19.5-26	22,697			1,109	1,735													2,844
12 SU-6T >26	6,917					951	166											1,117
13 SU-3AX <26	632			31	48													79
14 SU-3AX 26-33	2,224						204											204
15 SU-AX 33-40	1,525							125										125
16 SU-3AX 40-50	8,748							193	787									980
17 SU-3AX >50	0									0						0	0	0
18 CU-3AX <26	0			0	0													0
19 CU-3AX 26-50	3,938					298	52	39	159									548
20 CU-3AX >50	103									26	7					0	0	33
21 CU-2S2 <50	809						18	14	55									87
22 CU-2S2 50-60	3,505									881	236					0		1,117
23 CU 2S2 >60	67											53	1				0	54
24 CU-4AX <50	84						2	1	6									9
25 CU-4AX 50-60	346									87	23					0		110
26 CU-4AX >60	6											3	0	0			0	3
27 CU-3S2 <50	15						0	0	1									1
28 CU-3S2 50-70	893									202	54	107				0	0	363
29 CU-3S2 70-75	3,133												79				0	79
30 CU-3S2 >75	11,362													190	70		0	260
31 CU-5AX <50	1						0	0	0									0
32 CU-5AX 50-70	67									15	4	8				0	0	27
33 CU-5AX 70-75	215												5				0	5
34 CU-5AX >75	739													12	5		0	17
35 CU-6+AX <50	1						0	0	0									0
36 CU-6+AX 50-70	35									8	2	4				0	0	14
37 CU-6+AX 70-75	118												3				0	3
38 CU-6+AX >75	347													6	2		0	8
Total FHWA	514,784	0	2,039	1,140	1,783	1,249	442	372	1,008	1,219	326	175	88	208	77	0	0	10,126

TABLE 28

DISTRIBUTION OF KANSAS 1984 6,000 MILE TRUCK WEIGHT REGISTRATION GROUPS BY FHWA TRUCK TYPES

FHWA TRUCK TYPE	FHWA TRUCK NUMBERS	KANSAS WEIGHT REGISTRATION GROUPS <12	12-16	16-20	20-24	24-30	30-36	36-42	42-48	48-54	54-60	60-66	66-74	74-80	80-85.5	24-54	>66	KANSAS TRUCK NUMBERS
7 SU-4T <6	0	0																0
8 SU-4T 6-10	0	0																0
9 SU-4T >10	427,170	0																0
10 SU-6T <19.5	19,087	0	300															300
11 SU-6T 19.5-26	22,697			234	395													629
12 SU-6T >26	6,917					202	78											281
13 SU-3AX <26	632			7	11													18
14 SU-3AX 26-33	2,224						63											63
15 SU-AX 33-40	1,525							40										40
16 SU-3AX 40-50	8,748							92	188									280
17 SU-3AX >50	0									0						0	0	0
18 CU-3AX <26	0			0	0													0
19 CU-3AX 26-50	3,938					60	23	20	41									144
20 CU-3AX >50	103									4	4					0	0	8
21 CU-2S2 <50	809						7	6	12									25
22 CU-2S2 50-60	3,505									136	130					0		266
23 CU 2S2 >60	67											14	1				0	15
24 CU-4AX <50	84						1	1	1									3
25 CU-4AX 50-60	346									13	13					0		26
26 CU-4AX >60	6											1	0	0			0	1
27 CU-3S2 <50	15						0	0	0									0
28 CU-3S2 50-70	893									26	25	93				0	0	144
29 CU-3S2 70-75	3,133												109				0	109
30 CU-3S2 >75	11,362													146	83		0	229
31 CU-5AX <50	1						0	0	0									0
32 CU-5AX 50-70	67									2	2	7				0	0	11
33 CU-5AX 70-75	215												7				0	7
34 CU-5AX >75	739													9	5		0	14
35 CU-6+AX <50	1						0	0	0									0
36 CU-6+AX 50-70	35									1	1	4				0	0	6
37 CU-6+AX 70-75	118												4				0	4
38 CU-6+AX >75	347													4	3		0	7
Total Kansas Local Reg.	000,000	0	300	241	406	262	172	159	242	182	175	119	121	159	91	0	0	2,632

TABLE 29

DISTRIBUTION OF KANSAS 1984 FARM TRUCK WEIGHT REGISTRATION GROUPS BY FHWA VEHICLE TYPES

FHWA TRUCK TYPE	FHWA TRUCK NUMBERS	KANSAS WEIGHT REGISTRATION GROUPS <12	12-16	16-20	20-24	24-30	30-36	36-42	42-48	48-54	54-60	60-66	66-74	74-80	80-85.5	24-54	>66	KANSAS TRUCK NUMBERS
7 SU-4T <6	0	0																0
8 SU-4T 6-10	0	0																0
9 SU-4T >10	427,170	116,618																116,618
10 SU-6T <19.5	19,087	4,401	22,253															26,654
11 SU-6T 19.5-26	22,697			19,479	21,266													40,745
12 SU-6T >26	6,917					0	0											0
13 SU-3AX <26	632			542	592													1,135
14 SU-3AX 26-33	2,224						0											0
15 SU-AX 33-40	1,525							0										0
16 SU-3AX 40-50	8,748							0	0									0
17 SU-3AX >50	0									0						0	0	0
18 CU-3AX <26	0			0	0													0
19 CU-3AX 26-50	3,938					0	0	0	0									0
20 CU-3AX >50	103									0	0					300	0	300
21 CU-2S2 <50	809						0	0	0									0
22 CU-2S2 50-60	3,505									0	0					10,225		10,225
23 CU 2S2 >60	67											0	0				0	0
24 CU-4AX <50	84						0	0	0									0
25 CU-4AX 50-60	346									0	0					1,009		1,009
26 CU-4AX >60	6											0	0	0			0	0
27 CU-3S2 <50	15						0	0	0									0
28 CU-3S2 50-70	893									0	0	0				2,605	0	2,605
29 CU-3S2 70-75	3,133												0				0	0
30 CU-3S2 >75	11,362													0	0		0	0
31 CU-5AX <50	1						0	0	0									0
32 CU-5AX 50-70	67									0	0	0				195	0	195
33 CU-5AX 70-75	215												0				0	0
34 CU-5AX >75	739													0	0		0	0
35 CU-6+AX <50	1						0	0	0									0
36 CU-6+AX 50-70	35									0	0	0				102	0	102
37 CU-6+AX 70-75	118												0				0	0
38 CU-6+AX >75	347													0	0		0	0
Total Kansas Farm Reg.	000,000	121,019	22,253	20,021	21,858	0	0	0	0	0	0	0	0	0	0	14,437	0	199,588

TABLE 30

DISTRIBUTION OF KANSAS 1984 TAX UNIT OWNED TRUCK WEIGHT REGISTRATION GROUPS BY FHWA TRUCK TYPES

FHWA TRUCK TYPE	FHWA TRUCK NUMBERS	KANSAS WEIGHT REGISTRATION GROUPS <12	12-16	16-20	20-24	24-30	30-36	36-42	42-48	48-54	54-60	60-66	66-74	74-80	80-85.5	24-54	>66	KANSAS TRUCK NUMBERS
7 SU-4T <6	0	0																0
8 SU-4T 6-10	0	0																0
9 SU-4T >10	427,170	7,730																7,730
10 SU-6T <19.5	19,087	340	125															465
11 SU-6T 19.5-26	22,697			85	117													203
12 SU-6T >26	6,917					55	12											67
13 SU-3AX <26	632			2	3													6
14 SU-3AX 26-33	2,224						13											13
15 SU-AX 33-40	1,525							6										6
16 SU-3AX 40-50	8,748							14	24									38
17 SU-3AX >50	0									0						0	0	0
18 CU-3AX <26	0			0	0													0
19 CU-3AX 26-50	3,938					21	4	2	4									31
20 CU-3AX >50	103									1	0					0	0	1
21 CU-2S2 <50	809						2	1	1									4
22 CU-2S2 50-60	3,505									19	10					0		29
23 CU 2S2 >60	67											1	0				0	1
24 CU-4AX <50	84						0	0	0									0
25 CU-4AX 50-60	346									2	1					0		3
26 CU-4AX >60	6											0	0	0			0	0
27 CU-3S2 <50	15						0	0	0									0
28 CU-3S2 50-70	893									4	2	4				0	0	10
29 CU-3S2 70-75	3,133												7				0	7
30 CU-3S2 >75	11,362													24	18		0	42
31 CU-5AX <50	1						0	0	0									0
32 CU-5AX 50-70	67									0	0	0				0	0	0
33 CU-5AX 70-75	215												0				0	0
34 CU-5AX >75	739													2	1		0	3
35 CU-6+AX <50	1						0	0	0									0
36 CU-6+AX 50-70	35									0	0	0				0	0	0
37 CU-6+AX 70-75	118												0				0	0
38 CU-6+AX >75	347													1	1		0	2
Total Kansas Tax Unit Reg.	000,000	8,070	125	87	121	76	31	23	29	26	13	5	7	27	20	0	0	8,661

DISTRIBUTION OF 1984 KANSAS VEHICLE REGISTRATION REVENUES. The Kansas Department of Revenue prepares annually a Vehicle Registration Ledger. The most recent one is dated January 16, 1985, for the calendar year 1984. The registration revenues can be attributed by using (1) registration fees, (2) numbers of vehicles, and (3) the product of registration fees and the number of vehicles. The ledger accounts and the selected attributors are shown in Table 31, VEHICLE REGISTRATION REVENUE ATTRIBUTORS.

TABLE 31

VEHICLE REGISTRATION REVENUE ATTRIBUTORS
BY LEDGER ACCOUNTS

REGISTRATION FEES (R)	NUMBER OF VEHICLES (N)	PRODUCT OF REGISTRATION FEES AND NUMBER OF VEHICLES (RN)
Auto	Non-Highway	Quarter Pay
Antique	Lost Tag	72 Hour
Special Interest	Duplicate Registration	30 Day
American Radio	Special Engineering	15 Day
Motorcycle	Reflectorization Fees	
Trailers	Additional Fees	
Trucks	Personalized Permit Fee	
Motor Bike	1983 Adjustment	
	Transfers	
	Titles	
	Duplicate Titles	
	Safety Inspection	

Registration Fees (R) attributor was selected for those ledger accounts for which fees have been established by specific vehicle types whose numbers are known. The Number of Vehicles (N) attributor was selected for those ledger accounts for which fees do not vary or only marginally by specific vehicle types. The Product of Registration Fees and Numbers of Vehicles (RN) was selected for those ledger accounts which have fees that vary with specific vehicle types but for which the numbers of vehicles are not known. The 1984 Vehicle Registration Ledger accounts were attributed using the preceding attributors. The results will be converted to percentages by vehicle type and will be used to attribute the projected vehicle registration fees for the four year study period of 1985-88. Table 32, ATTRIBUTION OF 1984 VEHICLE REGISTRATION FEES - ALL VEHICLE TYPES lists the attribution by vehicle types and ledger accounts. Table 33 is similar to Table 32 but lists combinations of vehicle types.

TABLE 32

ATTRIBUTION OF 1984 VEHICLE REGISTRATION FEES
ALL VEHICLE TYPES

FHWA VEHICLE TYPE	KS 1984 AUTO REGULAR ADJ. FEES	KS 1984 AUTO ANTIQUE ADJ. FEES	KS 1984 AUTO SPEC. INT. ADJ. FEES	KS 1984 AUTO AM. RADIO ADJ. FEES	KS 1984 MOTORCYCLES REGULAR ADJ. FEES
1 Standard Auto	$16,317,032	$34,294	$16,575	$21,335	
2 Small Auto	6,371,499	17,713	8,560	11,009	
3 Motorcycle					$888,303
4 Intercity Bus					
5 Transit Bus					
6 School Bus					
7 SU-4T <6					
8 SU-4T 6-10					
9 SU-4T >10					
10 SU-6T <19.5					
11 SU-6T 19.5-26					
12 SU-6T >26					
13 SU-3AX <26					
14 SU-3AX 26-33					
15 SU-3AX 33-40					
16 SU-3AX 40-50					
17 SU-3AX >50					
18 CU-3AX <26					
19 CU-3AX 26-50					
20 CU-3AX >50					
21 CU-2S2 <50					
22 CU-2S2 50-60					
23 CU-2S2 >60					
24 CU-4AX <50					
25 CU-4AX 50-60					
26 CU-4AX >60					
27 CU-3S2 <50					
28 CU-3S2 50-70					
29 CU-3S2 70-75					
30 CU-3S2 >75					
31 CU-5AX <50					
32 CU-5AX 50-70					
33 CU-5AX 70-75					
34 CU-5AX >75					
35 CU-6+AX <50					
36 CU-6+AX 50-70 TYPE					
37 CU-6+AX 70-75					
38 CU-6+AX >75					
Totals	$22,688,531	$52,007	$25,135	$32,344	$888,303

TABLE 32 (CONTINUED)

ATTRIBUTION OF 1984 VEHICLE REGISTRATION FEES
ALL VEHICLE TYPES

FHWA VEHICLE TYPE	KS 1984 TRAILERS ADJ. FEES	KS 1984 NON-HIGHWAY ADJ. FEES	KS 1984 TRUCKS ADJ. FEES	KS 1984 QUARTER PAY ADJ. FEES	KS 1984 MOTOR BIKE ADJ. FEES
1 Standard Auto		$42,027			
2 Small Auto		21,717			
3 Motorcycle		4,410			$92,193
4 Intercity Bus		5			
5 TransitBus		4			
6 School Bus		318			
7 SU-4T <6		0	0		
8 SU-4T 6-10		0	0		
9 SU-4T >10	$184,714	22,608	11,107,334		
10 SU-6T <19.5	278,403	2,324	1,464,305	$66,891	
11 SU-6T 19.5-26	161,837	2,395	2,688,542	185,362	
12 SU-6T >26	41,820	212	872,149	114,866	
13 SU-3AX <26	6,622	67	74,943	5,168	
14 SU-3AX 26-33	14,450	41	196,547	26,052	
15 SU-3AX 33-40	6,922	20	112,930	14,134	
16 SU-3AX 40-50	49,308	141	938,220	113,495	
17 SU-3AX >50	0	0	0	0	
18 CU-3AX <26	0	0	0	0	
19 CU-3AX 26-50	30,696	101	474,370	60,671	
20 CU-3AX >50	9,760	17	51,476	3,900	
21 CU-2S2 <50	7,933	14	81,815	10,055	
22 CU-2S2 50-60	322,459	573	1,754,940	133,686	
23 CU-2S2 >60	3,238	6	72,104	7,554	
24 CU-4AX <50	815	1	8,334	1,009	
25 CU-4AX 50-60	32,796	57	173,088	13,199	
26 CU-4AX >60	178	0	4,210	440	
27 CU-3S2 <50	127	0	1,393	194	
28 CU-3S2 50-70	93,092	161	656,822	58,033	
29 CU-3S2 70-75	14,131	25	460,924	60,028	
30 CU-3S2 >75	66,420	116	2,812,254	410,133	
31 CU-5AX <50	0	0	0	0	
32 CU-5AX 50-70	6,983	12	49,529	4,400	
33 CU-5AX 70-75	943	2	31,068	4,100	
34 CU-5AX >75	4,313	8	183,076	26,777	
35 CU-6+AX <50	0	0	0	0	
36 CU-6+AX 50-70	3,643	6	25,720	2,264	
37 CU-6+AX 70-75	535	1	17,536	2,296	
38 CU-6+AX >75	2,041	4	86,453	12,607	
Totals	$1,354,180	$97,392	$24,400,086	$1,337,405	$92,193

TABLE 32 (CONTINUED)

ATTRIBUTION OF 1984 VEHICLE REGISTRATION FEES
ALL VEHICLE TYPES

FHWA VEHICLE TYPE	KS 1984 72 HOUR ADJ. FEES	KS 1984 30 DAY PAY ADJ. FEES	KS 1984 15 DAY PAY ADJ. FEES	KS 1984 LOST TAG ADJ. FEES	KS 1984 DUP. REG. ADJ. FEES	KS 1984 SPEC. ENG. ADJ. FEES
1 Standard Auto				$23,354	$16,727	$ 507
2 Small Auto				12,068	8,644	262
3 Motorcycle				2,451	1,755	53
4 Intercity Bus				3	2	0
5 Transit Bus				2	2	0
6 School Bus				177	127	4
7 SU-4T <6				0	0	0
8 SU-4T 6-10				0	0	0
9 SU-4T >10				12,563	8,998	273
10 SU-6T<19.5	$ 436	$ 2,149	$ 1,618	1,292	925	28
11 SU-6T 19.5-26	1,210	5,955	4,483	1,331	953	29
12 SU-6T >26	750	3,690	2,778	118	84	3
13 SU-3AX <26	34	166	125	37	27	1
14 SU-3AX 26-33	170	837	630	23	16	0
15 SU-3AX 33-40	92	454	342	11	8	0
16 SU-3AX 40-50	741	3,646	2,745	78	56	2
17 SU-3AX >50	0	0	0	0	0	0
18 CU-3AX <26	0	0	0	0	0	0
19 CU-3AX 26-50	396	1,952	1,469	56	40	1
20 CU-3AX >50	25	125	94	9	7	0
21 CU-2S2 <50	66	323	243	8	5	0
22 CU-2S2 50-60	872	4,295	3,233	318	228	7
23 CU-2S2 >60	49	243	183	3	2	0
24 CU-4AX <50	7	32	24	1	1	0
25 CU-4AX 50-60	86	424	319	31	23	1
26 CU-4AX > 60	3	14	11	0	0	0
27 CU-3S2 <50	1	6	5	0	0	0
28 CU-3S2 50-70	379	1,864	1,403	89	64	2
29 CU-3S2 70-75	392	1,929	1,452	14	10	0
30 CU-3S2 >75	2,676	13,177	9,918	64	46	1
31 CU-5AX <50	0	0	0	0	0	0
32 CU-5AX >50-70	29	141	106	7	5	0
33 CU-5AX 70-75	27	132	99	1	1	0
34 CU-5AX >75	175	860	648	4	3	0
35 CU-6+AX <50	0	0	0	0	0	0
36 CU-6+AX 50-70	15	73	55	3	2	0
37 CU-6+AX 70-75	15	74	56	1	0	0
38 CU-6+AX >75	82	405	305	2	1	0
Totals	$8,727	$42,968	$32,342	$54,121	$38,762	$1,175

TABLE 32 (CONTINUED)

ATTRIBUTION OF 1984 VEHICLE REGISTRATION FEES
ALL VEHICLE TYPE

FHWA VEHICLE TYPE	KS 1984 REFL. FEES ADJ. FEES	KS 1984 ADD. FEES ADJ. FEES	KS 1984 PERS. PERMIT ADJ. FEES	KS 1984 1984 ADJ. FEES	KS 1984 TRANSFERS ADJ. FEES
1 Standard Auto	$100,688	$2,148	$ 95,531	$109	$173,979
2 Small Auto	52,029	1,110	49,366	56	89,904
3 Motorcycle	10,566	225	10,025	11	18,257
4 Intercity Bus	12	0		0	21
5 Transit Bus	11	0		0	19
6 School Bus	762	16		1	1,316
7 SU-4T <6	0	0	0	0	0
8 SU-4T 6-10	0	0	0	0	0
9 SU-4T >10	54,164	1,156	51,391	58	93,592
10 SU-6T <19.5	5,569	119		6	9,622
11 SU-6T 19.5-26	5,738	122		6	9,914
12 SU-6T >26	508	11		1	877
13 SU-3AX <26	160	3		0	276
14 SU-3AX 26-33	98	2		0	169
15 SU-3AX 33-40	47	1		0	82
16 SU-3AX 40-50	338	7		0	584
17 SU-3AX >50	0	0		0	0
18 CU-3AX <26	0	0		0	0
19 CU-3AX 26-50	242	5		0	417
20 CU-3AX >50	40	1		0	70
21 CU-2S2 <50	33	1		0	57
22 CU-2S2 50-60	1,373	29		1	2,372
23 CU-2S2 >60	13	0		0	23
24 CU-4AX <50	3	0		0	6
25 CU-4AX 50-60	135	3		0	234
26 CU-4AX >60	1	0		0	1
27 CU-3S2 <50	1	0		0	1
28 CU-3S2 50-70	385	8		0	665
29 CU-3S2 70-75	59	1		0	102
30 CU-3S2 >75	278	6		0	480
31 CU-5AX <50	0	0		0	0
32 CU-5AX 50-70	29	1		0	50
33 CU-5AX 70-75	4	0		0	7
34 CU-5AX >75	18	0		0	31
35 CU-6+AX <50	0	0		0	0
36 CU-6+AX 50-70	15	0		0	26
37 CU-6+AX 70-75	2	0		0	4
38 CU-6+AX >75	9	0		0	15
Totals	$233,326	$4,978	$206,313	$252	$403,173

TABLE 32 (CONTINUED)

ATTRIBUTION OF 1984 VEHICLE REGISTRATION FEES
ALL VEHICLE TYPES

FHWA VEHICLE TYPE	KS 1984 TITLES ADJ. FEES	KS 1984 DUP. TITLES ADJ. FEES	KS 1984 SAFETY INSP. ADJ. FEES	KS 1984 TOTAL REG. FEES DOLLARS	KS 1984 TOTAL REG. FEES PERCENT
1 Standard Auto	$1,057,209	$21,269	$3,538	$17,917,604	32.88%
2 Small Auto	546,313	10,991	1,828	7,199,568	13.21
3 Motorcycle	110,942	2,232	371	1,141,241	2.09
4 Intercity Bus	126	3	0	7,065	0.01
5 Transit Bus	112	2	0	408	.00
6 School Bus	7,996	161	27	30,241	0.06
7 SU-4T <6	0	0	0	0	0.00
8 SU-4T 6-10	0	0	0	0	0.00
9 SU-4T >10	568,728	11,441	1,903	12,113,034	22.23
10 SU-6T <19.5	58,472	1,176	196	1,892,612	3.47
11 SU-6T 19.5-26	60,246	1,212	202	3,128,017	5.74
12 SU-6T >26	5,331	107	18	1,042,816	1.91
13 SU-3AX <26	1,679	34	6	89,305	0.16
14 SU-3AX 26-33	1,030	21	3	239,972	0.44
15 SU-3AX 33-40	498	10	2	135,487	0.25
16 SU-3AX 40-50	3,546	71	12	1,112,448	2.04
17 SU-3AX >50	0	0	0	0	0.00
18 CU-3AX <26	0	0	0	0	0.00
19 CU-3AX 26-50	2,536	51	8	572,825	1.05
20 CU-3AX >50	423	9	1	65,927	0.12
21 CU-2S2 <50	347	7	1	100,860	0.19
22 CU-2S2 50-60	14,416	290	48	2,248,049	4.12
23 CU-2S2 >60	141	3	0	83,522	0.15
24 CU-4AX <50	35	1	0	10,266	0.02
25 CU-4AX 50-60	1,422	29	5	221,744	0.41
26 CU-4AX >60	8	0	0	4,865	0.01
27 CU-3S2 <50	6	0	0	1,734	0.00
28 CU-3S2 50-70	4,040	81	14	816,705	1.50
29 CU-3S2 70-75	619	12	2	539,437	0.99
30 CU-3S2 >75	2,916	59	10	3,316,941	6.09
31 CU-5AX <50	0	0	0	0	0.00
32 CU-5AX 50-70	303	6	1	61,572	0.11
33 CU-5AX 70-75	41	1	0	36,407	0.07
34 CU-5AX >75	190	4	1	216,003	0.40
35 CU-6+AX <50	0	0	0	0	0.00
36 CU-6+AX 50-70	158	3	1	31,968	0.06
37 CU-6+AX 70-75	23	0	0	20,533	0.04
38 CU-6+AX >75	89	2	0	101,965	0.19
	89	2	0	101,965	0.19
Totals	$2,449,944	$49,287	$8,198	$54,501,139	100.00%

TABLE 33

ATTRIBUTION OF 1984 VEHICLE REGISTRTAION FEES BY
COMBINED VEHICLE TYPES

	KS 1984 AUTO REGULAR ADJ. FEES	KS 1984 AUTO ANTIQUE ADJ. FEES	KS 1984 AUTO SPEC. INT. ADJ. FEES	KS 1984 AUTO AM. RADIO ADJ. FEES	KS 1984 MOTORCYCLES REGULAR ADJ. FEES
1 Large Autos	$16,317,032	$34,294	$16,575	$21,335	0
2 Small Autos	6,371,499	17,713	8,560	11,009	0
3 Motorcycles	0	0	0	0	$888,303
4 Intercity Bus	0	0	0	0	0
5 Other Buses	0	0	0	0	0
6 Pickups/Vans	0	0	0	0	0
7 SU Trucks <26	0	0	0	0	0
8 SU Trucks >26	0	0	0	0	0
9 CU Trucks <50	0	0	0	0	0
10 CU Trucks 50-70	0	0	0	0	0
11 CU Trucks 70-75	0	0	0	0	0
12 CU Trucks >75	0	0	0	0	0
	0	0	0	0	0
Totals	$22,688,531	$52,007	$25,135	$32,344	$888,303

1 Autos	$22,688,531	$52,007	$25,135	$32,344	0
2 Motorcycles	0	0	0	0	$888,303
3 Buses	0	0	0	0	0
4 Pickups/Vans	0	0	0	0	0
5 SU Trucks	0	0	0	0	0
6 CU Trucks	0	0	0	0	0
	0	0	0	0	0
Totals	$22,688,531	$52,007	$25,135	$32,344	$888,303

1 Pass. Vehicles	$22,688,531	$52,007	$25,135	$32,344	$888,303
2 Trucks	0	0	0	0	0
	0	0	0	0	0
Totals	$22,688,531	$52,007	$25,135	$32,344	$888,303

TABLE 33 (CONTINUED)

ATTRIBUTION OF 1984 VEHICLE REGISTRATION FILES BY COMBINED VEHICLE TYPES

	KS 1984 TRAILERS ADJ. FEES	KS 1984 NON-HIGHWAY ADJ. FEES	KS-1984 TRUCKS ADJ. FEES	KS 1984 QUARTER PAY ADJ. FEES	KS 1984 MOTOR BIKE ADJ. FEES
1 Large Autos	$ 0	$42,027	0	0	0
2 Small Autos	0	21,717	0	0	0
3 Motorcycles	0	4,410	0	0	$92,193
4 Intercity Bus	0	5	0	0	0
5 Other Buses	0	322	0	0	0
6 Pickups/Vans	184,714	22,608	$11,107,334	0	0
7 SU Trucks <26	446,862	4,786	4,227,791	$257,422	0
8 SU Trucks >26	112,499	414	2,119,846	268,546	0
9 CU Trucks <50	39,572	116	565,913	72,019	0
10 CU Trucks 50-70	482,150	831	2,787,890	233,476	0
11 CU Trucks 70-75	15,609	27	509,529	66,424	0
12 CU Trucks >75	72,773	127	3,081,783	449,517	0
Totals	$1,354,180	$97,392	$24,400,086	$1,337,405	$92,193
1 Autos	$	63,744	$ 0	$ 0	$ 0
2 Motorcycles	0	4,410	0	0	$92,193
3 Buses	0	327	0	0	0
4 Pickups/Vans	$184,714	22,608	11,107,334	0	0
5 SU Trucks	559,362	5,200	6,347,637	$525,968	0
6 CU Trucks	610,104	1,102	6,945,114	811,437	0
Totals	$1,354,180	$97,392	$24,400,086	$1,337,405	$92,193
1 Pass. Vehicles	$ 184,714	$91,090	$11,107,334	$ 0	$92,193
2 Trucks	1,169,466	6,301	13,292,752	1,337,405	0
Totals	$1,354,180	$97,392	$24,400,086	$1,337,405	$92,193

TABLE 33 (CONTINUED)

ATTRIBUTION OF 1984 VEHICLE REGISTRATION FEES BY COMBINED VEHICLE TYPES

	KS 1984 72 HOUR ADJ. FEES	KS 1984 30 DAY PAY ADJ. FEES	KS 1984 15 DAY PAY ADJ. FEES	KS 1984 LOST TAG ADJ. FEES	KS 1984 DUP. REG. ADJ. FEES	KS 1984 SPEC. ENG. ADJ. FEES
1 Large Autos	$ 0	$ 0	$ 0	$23,354	$16,727	$ 507
2 Small Autos	0	0	0	12,068	8,644	262
3 Motorcycles	0	0	0	2,451	1,755	53
4 Intercity Bus	0	0	0	3	2	0
5 OtherBuses	0	0	0	179	128	4
6 Pickups/Vans	0	0	0	14,563	8,998	273
7 SU Trucks <26	1,680	8,270	6,225	2,660	1,905	58
8 SU Trucks >26	1,752	8,628	6,494	230	165	5
9 CU Trucks >50	470	2,314	1,742	65	46	1
10 CU Trucks 50-70	1,458	7,180	5,404	462	331	10
11 CU Trucks 70-75	433	2,134	1,606	15	11	0
12 CU Trucks >75	2,933	14,442	10,871	71	51	2
Totals	$8,727	$42,968	$32,342	$54,121	$38,762	$1,175

1 Autos	$ 0	$ 0	$ 0	$35,423	$25,370	$ 769
2 Motorcycles	0	0	0	2,451	1,755	53
3 Buses	0	0	0	182	130	4
4 Pickups/Van	0	0	0	12,563	8,998	273
5 SU Trucks	3,432	16,898	12,719	2,890	2,070	63
6 CU Trucks	5,295	26,070	19,623	612	438	13
Totals	$8,727	$42,968	$32,342	$54,121	$38,762	$1,175

1 Pass. Vehicles	$ 0	$ 0	$ 0	$50,619	$36,254	$1,099
2 Trucks	8,727	42,968	32,342	3,502	2,508	76
Totals	$8,727	$42,968	$34,342	$54,121	$38,762	$1,175

TABLE 33 (CONTINUED)

ATTRIBUTION OF 1984 VEHICLE REGISTRATION FEES BY COMBINED VEHICLE TYPES

	KS 1984 REFL. FEES ADJ. FEES	KS 1984 ADD. FEES ADJ. FEES	KS 1984 PERS. PERMIT ADJ. FEES	KS 1984 1984 ADJ. FEES	KS 1984 TRANSFERS ADJ. FEES
1 Large Autos	$100,688	$2,148	$ 95,531	$109	$173,979
2 Small Autos	52,029	1,110	49,366	56	89,904
3 Motorcycles	10,566	225	10,025	11	18,257
4 Intercity Bus	12	0	0	0	21
5 Other Buses	772	16	0	1	1,334
6 Pickups/Vans	54,164	1,156	51,391	58	93,592
7 SU Trucks <26	11,466	245	0	12	19,813
8 SU Trucks >26	991	21	0	1	1,712
9 CU Trucks <50	278	6	0	0	481
10 CU Trucks 50-70	1,992	42	0	2	3,441
11 CU Trucks 70-75	65	1	0	0	112
12 CU Trucks >75	304	6	0	0	526
Totals	$233,326	$4,978	$206,313	$252	$403,173
1 Autos	$152,715	$3,258	$144,897	$165	$263,822
2 Motorcycles	10,566	225	10,025	11	18,257
3 Buses	784	17	0	1	1,355
4 Pickups/Vans	54,164	1,156	51,391	58	93,592
5 SU Trucks	12,457	266	0	13	21,526
6 CU Trucks	2,639	56	0	3	4,561
Totals	$233,326	$4,978	$206,313	$252	$403,173
1 Pass. Vehicles	$218,229	$4,656	$206,313	$236	$377,087
2 Trucks	15,097	322	0	16	26,086
Totals	$233,326	$4,978	$206,313	$252	$403,173

TABLE 33 (CONTINUED)

ATTRIBUTION OF 1984 VEHICLE REGISTRATION FEES BY COMBINED VEHICLE TYPES

	KS 1984 TITLES ADJ. FEES	KS 1984 DUP. TITLES ADJ. FEES	KS 1984 SAFETY INSP. ADJ. FEES	KS 1984 TOTAL REG. FEES DOLLARS	KS 1984 TOTAL REG. FEES PERCENT
1 Large Autos	$1,057,029	$21,269	$3,538	$17,917,604	32.8%
2 Small Autos	546,313	10,991	1,828	7,199,568	13.21%
3 Motorcycles	110,942	2,232	371	1,141,241	2.09%
4 Intercity Bus	126	3	0	7,065	0.01%
5 Other Buses	8,108	163	27	30,649	0.06%
6 Pickups/Vans	568,728	11,441	1,903	12,113,034	22.23%
7 SU Trucks <26	120,398	2,422	403	5,109,934	9.38%
8 SU Trucks >26	10,405	209	35	2,530,723	4.64%
9 CU Trucks <50	2,924	59	10	685,683	1.26%
10 CU Trucks 50-70	20,912	421	70	3,534,353	6.48%
11 CU Trucks 70-75	683	14	2	596,376	1.09%
12 CU Trucks >75	3,195	64	11	3,634,908	6.67%
Totals	$2,449,944	$49,287	$8,198	$54,501,139	100.00%

1 Autos	$1,603,523	$32,259	$5,366	$25,117,172	46.09%
2 Motorcycles	110,942	2,232	371	1,141,241	2.09%
3 Buses	8,234	166	28	37,714	0.07%
4 Pickups/Vans	568,728	11,441	1,903	12,113,034	22.23%
5 SU Trucks	130,803	2,631	438	7,640,657	14.02%
6 CU Trucks	27,714	558	93	8,451,321	15.51%
Totals	$2,449,944	$49,287	$8,198	$54,501,139	100.00%

1 Pass. Vehicles	$2,291,427	$46,098	$7,668	$38,409,161	70.47%
2 Trucks	158,517	3,189	530	16,091,978	23.17%
Totals	$2,449,944	$49,287	$8,198	$54,501,139	100.00%

ATTRIBUTION OF OTHER VEHICLE RELATED AND MISCELLANEOUS REVENUES

In addition to the revenues derived from vehicle registrations discussed earlier, there are other vehicle related and miscellaneous revenues which are, more or less, related to vehicle registrations. These revenues are derived from motor carriers, drivers' license fees, dealer licensing and dealer reciprocity fees, special vehicle permit fees, miscellaneous income, and a transfer of a portion of the general sales tax. Table 36, OTHER VEHICLE RELATED AND MISCELLANEOUS REVENUE ATTRIBUTORS, lists the selected attributors. Table 37, ATTRIBUTION OF OTHER VEHICLE RELATED AND MISCELLANEOUS INCOME BY VEHICLE TYPES, lists the attributions by vehicle types and revenue sources. Table 38 is similar to Table 19 but by combinations of vehicle types.

MOTOR CARRIER REVENUES. Revenue from motor carriers are derived from inspection and regulation fees and from reciprocity agreements with other states and provinces. The two motor carrier revenue sources cover essentially the same vehicle population and will be attributed in the same manner, even though the following discussion refers to reciprocity agreements.

The Kansas Department of Revenue has agreements with most states and certain provinces whereby registration and other fees assessed interstate carriers are shared by the states and provinces through which the carriers travel. The agreements include the Multistate Reciprocal Agreement (MRA), the Uniform Prorate and Reciprocity Agreement (UPRA), and the International Registration Plan (IRP). The MRA allows full reciprocity of registration fees for vehicles that are registered in a member state. The Prorate Agreement provides for a partial license to be issued by each member state in which the vehicle operates. The IRP incorporated the UPRA features of the prorated registration fees and the MRA flexibility of a single plate system. IRP has, in large part, superseded the other agreements and will likely, in time, become the only significant multi-state agreement. Table 34, TYPES OF VEHICLE REGISTRATION RECIPROCITY AND PRORATION AGREEMENTS BETWEEN KANSAS AND OTHER STATES AND CANADIAN PROVINCES, with which the State of Kansas has agreements as well as the type of agreement.

TABLE 34

TYPES OF VEHICLE REGISTRATION RECIPROCITY AND PRORATION AGREEMENTS BETWEEN KANSAS AND OTHER STATES AND CANADIAN PROVINCES

NO AGREEMENT	MULTISTATE RECIPROCAL AGREEMENT (MRA)	UNIFORM PRORATION AND RECIPROCITY AGREEMENT (UPRA)	INTERNATIONAL REGISTRATION PLAN (IRP)
Hawaii	Connecticut	Alaska	Alabama
Manitoba	Delaware	British Columbia	Alberta
New York	Dist. of Columbia	California*	Arizona
Ohio	Florida*	Nevada	Arkansas
Ontario	Georgia	New Mexico	Colorado
Saskatchewan	Indiana		Idaho
Quebec	Maine*		Illinois
	Maryland		Iowa
	Massachusetts		Kentucky
	Michigan*		Louisiana
	New Hampshire		Minnesota
	New Jersey		Mississippi
	Pennsylvania*		Missouri
	Rhode Island		Montana
	South Carolina*		Nebraska
	Vermont		North Carolina
	Washington*		North Dakota
	West Virginia		Oklahoma
			Oregon
			South Dakota
			Tennessee
			Texas
			Utah
			Virginia
			Wisconsin
			Wyoming

*States with statutory authority to enter into the International Registration Plans.

The Kansas Department of Revenue, in its 1984 Vehicular Statistical Information relating to IRP and Uniform Fleet Registration, lists the numbers of trucks and buses by Kansas weight registration groups without regard to axle weights and spacings. Table 35, DISTRIBUTION OF 1984 UNIFORM PRORATE AND INTERNATIONAL REGISTRATION PLAN TRUCK WEIGHT REGISTRATION GROUPS BY FHWA VEHICLE TYPES, was developed with the use of Table 25, MATRIX OF FHWA AND KANSAS TRUCK POPULATIONS.

TABLE 35

DISTRIBUTION OF 1984 UNIFORM PRORATE AND INTERNATIONAL REGISTRATION PLAN
TRUCK WEIGHT REGISTRTION GROUPS BY FHWA VEHICLE TYPES

FHWA VEHICLE TYPE	FHWA VEHICLE NUMBERS	KANSAS WEIGHT REGISTRATION GROUPS 12-16	16-20	20-24	24-30	30-36	36-42	42-48	48-54	54-60	60-66	66-74	74-80	80-85.5	24-54	>66	KANSAS TOTALS
7 SU-4T <6																	0
8 SU-4T 6-10																	0
9 SU-4T >10	427,170	542	1,042	264	704												2,552
10 SU-6T <19.5	19,087	106															106
11 SU-6T 19.5-26	22,697		109	28													136
12 SU-6T >26	6,917				30	135											165
13 SU-3AX <26	632		3	1													4
14 SU-3AX 26-33	2,224					140											140
15 SU-AX 33-40	1,525						76										76
16 SU-3AX 40-50	8,748						131	443									574
17 SU-3AX <50	0								0								0
18 CU-3AX <26	0		0	0													0
19 CU-3AX 26-50	3,938				10	44	25	85									164
20 CU-3AX >50	103								16	33							49
21 CU-2S2 <50	809					15	9	29									52
22 CU-2S2 50-60	3,505								558	1,116							1,674
23 CU 2S2 >60	67										80	13					92
24 CU-4AX <50	84					2	1	3									5
25 CU-4AX 50-60	346								55	110							165
26 CU-4AX >60	6										1	0	12				13
27 CU-3S2 <50	15					0	0	1									1
28 CU-3S2 50-70	893								103	206	686						995
29 CU-3S2 70-75	3,133											1,024					1,024
30 CU-3S2 >75	11,362												22,763	1,785			24,549
31 CU-5AX <50	1					0	0	0									0
32 CU-5AX 50-70	67					0			8	15	51						75
33 CU-5AX 70-75	215											70					70
34 CU-5AX >75	739												1,481	116			1,597
35 CU-6+AX <50	1					0	0	0									0
36 CU-6+AX 50-70	35								4	8	27						39
37 CU-6+AX 70-75	118											39					39
38 CU-6+AX >75	347												695	55			750
Total IRP/Prorate Reg.		648	1,154	292	744	336	242	560	745	1,489	844	1,145	24,951	1,956			35,106

The 1984 revenue derived from the Reciprocity Agreements will be attributed to the various vehicle classes and to combination of vehicle classes using an attributor sensitive to numbers of vehicles, to mileage of vehicles, and to weight registration fees. This attributor is based on the following assumptions:

- Foreign based Interstate vehicles will be in the same proportion as Kansas based Interstate vehicles.

- Mileage for both foreign and Kansas based vehicles is proportional to total Kansas Mileage by vehicle type.

- Kansas registration weight group fees, even though not identical to other states, are a surrogate measure of registration weight group fees.

The attributor sensitive to number (N), mileage (M) and registration fees (R) would be their product. Number (N) is the number of IRP/Prorate vehicles from Table 35. Mileage (M) is the projected mileage by vehicle type during the study period. Registration fee (F) is the Kansas weight registration fee by weight group. The 1984 reciprocity revenue will be attributed using the product of number (n), mileage (M), and registration fee (R). The results will be converted to percentages by vehicle type and will be used to attribute the projected reciprocity revenues for the four-year study period of 1985-88.

DRIVERS LICENSE FEES. Kansas issues four levels of operators licenses which permit the operation of certain classes of vehicles. A Class D license authorizes the operation of motorcycles and motor bikes only. A Class C license authorizes the operation of automobiles and single unit trucks through 24,000 pounds gross vehicle weight and all vehicles with farm registrations. A Class B license, in addition to those vehicles authorized by a Class C license authorizes the operation of buses and single unit trucks greater than 24,000 pounds. A Class A license authorizes the operation of all classes of vehicles including combination units but excluding motorcycles. The 1984 driver license fees will be attributed using the number of vehicles (N) attributor. The results will be converted to percentages by vehicle type and will be used to attribute the portion of drivers license fees transferred to the Highway Fund during the four-year study period (1985-88).

DEALER LICENSING AND RECIPROCITY FEES. Motor vehicle dealers are charged a fee for licensing and reciprocity privileges. The 1984 dealer licensing and reciprocity fees will be attributed using the number of vehicles (N) attributor. The results will be converted to percentages by vehicle type and will be used to attribute those fees projected for the four-year study period (1985-88).

SPECIAL VEHICLE PERMITS. The Kansas Department of Transportation issues permits for the operation of vehicles whose dimensions exceed statutory maximums for weight, width and height. The permit is intended to provide for movement of non-divisible loads over an approved route. The non-divisible loads are usually weight oriented and involve loads above the legal maximum. The 1984 special vehicle permit fees, then, will be attributed to the number of vehicles (N) attributor but restricted to those vehicle with registered gross vehicle weights (GVW) in excess of 75,000 pounds. The results will be converted to percentages by vehicle types and will be used to attribute those fees projected for the four-year study period (1985-88).

MISCELLANEOUS INCOME. The Highway Fund is credited with a number of revenue sources which have little, if any, relationship to vehicle types. Typical items are commodity sales, mineral royalties, insurance reimbursement, and sign board license fees. The 1984 miscellaneous income will be attributed to the number of vehicles (N) attributor. The results will be converted to percentages by vehicle types and will be used to attribute miscellaneous income projected for the four-year study period (1985-88).

SALES TAX TRANSFER. The 1983 State Highway Finance Package (HB 2566) requires a transfer from the State General Fund to the State Highway Fund of a specified portion of the state sales tax receipts attributable to sales of new and used motor vehicles. Sales tax is not paid on the purchase price of trucks used in interstate commerce. Purchase statements filed with the Department of Revenue indicate that most trucks larger than pickups and vans are used in interstate commerce and are exempt from sales tax. Sales tax transfers will be attributed on the number of vehicles (N) attributor to those vehicles subject to sales tax. Trucks heavier than pickups and vans will be credited with 1% of sales tax transfers with the remainder credited to autos, pickups and vans. This attribution is based on the following assumptions:

- Trucks heavier than pickups and vans represent about 6.5% of the Kansas registered vehicle population.

- Sales of trucks heavier than pickups and vans represent about 9% of total vehicle sales.

- Most trucks heavier than pickups and vans are used in interstate commerce and are exempt from sales tax on their purchase price.

TABLE 36

OTHER VEHICLE RELATED AND MISCELLANEOUS REVENUE ATTRIBUTORS

NUMBER VEHICLES (N)	PRODUCT OF REGISTRATION FEES, NUMBER OF VEHICLES AND MILEAGE (RNM)	OTHER ATTRIBUTORS
Drivers License	Motor Carrier Inspection and Regulation	Special vehicle permits (by number of heaviest vehicles)
Dealer Licensing and Reciprocity	Uniform Prorate and Internation Registration Plan	
Misc. Income		Sales tax transfer (combination of taxable sales and numbers of vehicles)

TABLE 37

ATTRIBUTION OF OTHER VEHICLE RELATED AND MISCELLANEOUS REVENUES BY ALL VEHICLE TYPES

FHWA VEHICLE TYPE	KS 1984 IRP/PRORATE FEES ADJ. FEES	KS 1984 IRP/PRORATE FEES PERCENT	KS 1984 MO. CARRIER INSP. & REG. ADJ. FEES	KS 1984 MO. CARRIER INSP. & REG. PERCENT	KS 1984 DRIVER LICENSE ADJ. FEES	KS 1984 DRIVER LICENSE PERCENT	KS 1984 DEALER & RECIP. ADJ. FEES	KS 1984 DEALER & RECIP. PERCENT	KS 1984 SP. VEH. PERMITS ADJ. FEES	KS 1984 SP. VEH. PERMITS PERCENT	KS 1984 MISC. INCOME ADJ. FEES	KS 1984 MISC. INCOME PERCENT
1 Standard Auto	$ 0	0.00	$ 0	0.00%	$1,901,347	43.15%	$334,009	43.15%		0.00%	$ 733,167	43.15%
2 Small Auto	0	0.00	0	0.00	982,522	22.30	172,599	22.30		0.00	378,864	22.30
3 Motorcycle	0	0.00	0	0.00	199,525	4.53	33,050	4.53		0.00	76,938	4.53
4 Intercity Bus	4	.00	4	.00	226	0.01	40	0.01		0.00	87	0.01
5 Transit Bus	0	0.00	0	0.00	202	.00	36	.00		0.00	78	.00
6 School Bus	0	0.00	0	0.00	14,380	0.33	36	.00		0.00	5,545	0.33
7 SU-4T <6	0	0.00	0	0.00	14,380	0.33	0	0.00		0.00	0	0.00
8 SU-4T 6-10	0	0.00	0	0.00	0	0.00	0	0.00		0.00	0	0.00
9 SU-4T >10	940,782	6.02	83,157	6.02	1,160,282	26.33	203,826	26.33		0.00	447,409	26.33
10 SU-6T <19.5	992	0.01	88	0.01	53,173	0.21	9,341	1.21		0.00	20,504	1.21
11 SU-6T 19.5-26	2,267	0.01	200	0.01	30,528	0.69	5,363	0.69		0.00	11,772	0.69
12 SU-6T >26	2,312	0.01	204	0.01	5,433	0.12	954	0.12		0.00	2,095	0.12
13 SU-3AX <26	2	.00	0	.00	855	0.02	150	0.02		0.00	330	0.02
14 SU-3AX 26-33	623	.00	55	.00	1,852	0.04	325	0.04		0.00	714	0.04
15 SU-AX 33-40	361	.00	32	.00	896	0.02	157	0.02		0.00	346	0.02
16 SU-3AX 40-50	17,914	0.11	1,583	0.11	6,377	0.14	1,120	0.14		0.00	2,459	0.14
17 SU-3AX >50	0	0.00	0	0.00	0	0.00	0	0.00		0.00	0	0.00
18 CU-3AX <26	0	0.00	0	0.00	0	0.00	0	0.00		0.00	0	0.00
19 CU-3AX 26-50	2,897	0.02	256	0.02	3,121	0.07	548	0.07		0.00	1,204	0.07
20 CU-3AX >50	50	.00	4	.00	761	0.02	134	0.02		0.00	294	0.02
21 CU-2S2 <50	207	.00	18	.00	625	0.01	110	0.01		0.00	241	0.01
22 CU-2S2 50-60	81,977	0.52	7,246	0.52	25,927	0.59	4,555	0.59		0.00	9,998	0.59
23 CU 2S2 >60	131	.00	12	.00	254	0.01	45	0.01		0.00	98	0.01
24 CU-4AX <50	3	.00	0	.00	63	.00	11	.00		0.00	24	.00
25 CU-4AX 50-60	749	.00	66	.00	2,558	0.06	4,555	0.59		0.00	986	0.06
26 CU-4AX >60	3	.00	0	.00	14	.00	2	.00		0.00	5	.00
27 CU-3S2 <50	0	.00	0	.00	10	.00	2	.00		0.00	4	.00
28 CU-3S2 50-70	20,191	0.13	1,785	0.13	7,266	0.16	1,276	0.16		0.00	2,802	0.16
29 CU-3S2 70-75	131,949	0.84	11,663	0.84	1,112	0.03	195	0.03		0.00	429	0.03
30 CU-3S2 >75	14,363,015	91.86	1,269,567	91.86	5,245	0.12	921	0.12	$294,625	91.27	2,022	0.12
31 CU-5AX <50	0	0.00	0	0.00	0	0.00	0	0.00		0.00	0	0.00
32 CU-5AX 50-70	88	0.00	8	.00	545	0.01	96	0.01		0.00	210	0.01
33 CU-5AX 70-75	531	0.35	47	.00	73	.00	13	.00		0.00	28	.00
34 CU-5AX >75	55,087	0.35	4,869	0.35	341	0.01	60	0.01	19,195	5.94	132	0.01
35 CU-6+AX <50	0	0.00	0	0.00	0	0.00	0	0.00		0.00	0	0.00
36 CU-6+AX 50-70	21	.00	2	.00	284	0.01	50	0.01		0.00	109	0.01
37 CU-6+AX 70-75	148	.00	13	0.08	42	.00	7	.00		0.00	16	.00
38 CU-6+AX >75	12,652	0.08	1,118				28	.00	9,023	2.80	62	.00
Totals	$15,635,000	100.00%	$1,382,000	100.00%	$4,406,000	100.00%	$774,000	100.00%	$322,806	100.00%	$1,698,971	100.00%

TABLE 38

ATTRIBUTION OF OTHER VEHICLE RELATED AND MISCELLANEOUS
REVENUES BY COMBINATION OF VEHICLE TYPES

FHWA VEHICLE TYPE	KS 1984 IRP/PRORATE FEES ADJ. FEES	KS 1984 IRP/PRORATE FEES PERCENT	KS 1984 MO. CARRIER INSP. & REG. ADJ. FEES	KS 1984 MO. CARRIER INSP. & REG. PERCENT	KS 1984 DRIVER LICENSE ADJ. FEES	KS 1984 DRIVER LICENSE PERCENT	KS 1984 DEALER & RECIP. ADJ. FEES	KS 1984 DEALER & RECIP. PERCENT	KS 1984 SP. VEH. PERMITS ADJ. FEES	KS 1984 SP. VEH. PERMITS PERCENT	KS 1984 MISC. INCOME ADJ. FEES	KS 1984 MISC. INCOME PERCENT
1 Standard Auto	$ 0	0.00%	$ 0	0.00%	$1,901,347	43.15%	$334,009	43.15%	$ 0	0.00%	$ 733,167	43.15%
2 Small Auto	0	0.00	0	0.00	982,522	22.30	172,599	22.30	0	0.00	378,864	22.30
3 Motorcycle	0	0.00	0	0.00	199,525	4.53	35,050	4.53	0	0.00	76,938	4.53
4 Intercity Buses	51	.00	4	.00	226	0.01	40	0.01	0	0.00	87	0.01
5 Transit Buses	0	0.00	0	.00	14,583	0.33	2,562	0.33	0	0.00	5,623	0.33
6 Pickups/Vans	940,782	6.02	83,157	6.02	1,160,282	26.33	203,826	26.33	0	0.00	447,409	26.33
7 SU Trucks <26	3,261	0.02	288	0.02	84,555	1.92	14,854	1.92	0	0.00	32,605	1.92
8 SU Trucks <26	21,210	0.14	1,875	0.14	14,559	0.33	2,558	0.33	0	0.00	5,614	0.33
9 CU Trucks <50	3,106	0.02	275	0.02	3,819	0.09	671	0.09	0	0.00	1,473	0.09
10 CU Trucks 50-70	103,209	0.66	9,123	0.66	37,609	0.85	6,607	0.85	0	0.00	14,502	0.85
11 CU Trucks 70-75	132,628	0.85	11,723	0.85	1,227	0.03	216	0.03	0	0.00	473	0.03
12 CU Trucks >75	14,430,754	92.30	1,275,555	92.30	5,747	0.13	1,010	0.13	322,806	100.00	2,216	0.13
Totals	$15,635,000	100.00%	$1,382,000	100.00%	$4,406,000	100.00%	$774,000	100.00%	$322,806	100.00%	$1,698,971	100.00%

FHWA VEHICLE TYPE	KS 1984 IRP/PRORATE FEES ADJ. FEES	KS 1984 IRP/PRORATE FEES PERCENT	KS 1984 MO. CARRIER INSP. & REG. ADJ. FEES	KS 1984 MO. CARRIER INSP. & REG. PERCENT	KS 1984 DRIVER LICENSE ADJ. FEES	KS 1984 DRIVER LICENSE PERCENT	KS 1984 DEALER & RECIP. ADJ. FEES	KS 1984 DEALER & RECIP. PERCENT	KS 1984 SP. VEH. PERMITS ADJ. FEES	KS 1984 SP. VEH. PERMITS PERCENT	KS 1984 MISC. INCOME ADJ. FEES	KS 1984 MISC. INCOME PERCENT
1 Autos	$ 0	0.00%	$ 0	0.00%	$2,883,868	65.45%	$506,608	65.45%	$ 0	0.00%	$1,113,031	65.45%
2 Motorcycles	0	0.00	0	0.00	199,525	4.53	35,050	4.53	0	0.00	76,838	4.53
3 Buses	51	.00	4	.00	14,809	0.34	2,601	0.34	0	0.00	5,710	0.34
4 Pickups/Vans	940,782	6.02	83,157	6.02	1,160,282	26.33	203,826	26.33	0	0.00	447,409	26.33
5 SU Trucks	24,470	0.16	2,163	0.16	99,114	2.25	17,411	2.25	0	0.00	38,219	2.25
6 CU Trucks	14,669,697	93.83	1,296,675	93.83	48,402	1.10	8,503	1.10	322,806	100.00	18,664	1.10
Totals	$15,635,000	100.00%	$1,382,000	100.00%	$4,406,000	100.00%	$774,000	100.00%	$322,806	100.00%	$1,698,971	100.00%

FHWA VEHICLE TYPE	KS 1984 IRP/PRORATE FEES ADJ. FEES	KS 1984 IRP/PRORATE FEES PERCENT	KS 1984 MO. CARRIER INSP. & REG. ADJ. FEES	KS 1984 MO. CARRIER INSP. & REG. PERCENT	KS 1984 DRIVER LICENSE ADJ. FEES	KS 1984 DRIVER LICENSE PERCENT	KS 1984 DEALER & RECIP. ADJ. FEES	KS 1984 DEALER & RECIP. PERCENT	KS 1984 SP. VEH. PERMITS ADJ. FEES	KS 1984 SP. VEH. PERMITS PERCENT	KS 1984 MISC. INCOME ADJ. FEES	KS 1984 MISC. INCOME PERCENT
1 Pass.Vehicles	$ 940,833	6.02%	$ 83,162	6.02%	$4,258,484	96.65%	$748,086	96.65%	$ 0	0.00%	$1,642,088	96.65%
2 Trucks	14,694,167	93.98	1,298,838	93.98	147,516	3.35	25,914	3.35	322,806	100.00	56,883	3.35
Totals	$15,635,000	100.00%	$1,382,000	100.00%	$4,406,000	100.00%	$774,000	100.00%	$322,806	100.00%	$1,698,971	100.00%

CHAPTER 4
PROJECTED REVENUES AND COST RESPONSIBILITY

PROJECTED 1985-1988 REVENUES

The allocated expenditures discussed earlier in this study included the construction program, administrative functions, and the freeway debt services. For consistency, then the revenues to be attributed will include only those funds available for the state highway and freeway funds. This excludes statutory transfers such as the Special City and County Highway Fund and the County Equalization and Adjustment Fund. Table 1, PROJECTED 1985-1988 REVENUES FOR FREEWAY AND HIGHWAY FUNDS, lists the projected revenues and aggregates them into three general categories. The categories consist of Motor Vehicle Registrations, Other Non-Fuel Revenues, and Fuel Revenues. Table 1 also notes that the 1985-1988 expenditures exceed the 1985-1988 revenues with the difference satisfied by balance drawdowns and fund transfers.

ATTRIBUTION OF MOTOR VEHICLE REGISTRATIONS. Table 2, 1985-1988 PROJECTED MOTOR VEHICLE REGISTRATION REVENUES, lists the revenues by the individual and total motor vehicle registration accounts for the 38 vehicle classes used in the study. Table 3 is similar to table 2 but shows the attributed Motor Vehicle Registration Revenues by various combinations of vehicles. Passenger vehicles contributed 53.02% and trucks 46.98% of the projected $272,000,000 motor vehicle registration fees during the four year study period.

ATTRIBUTION OF OTHER NON-FUEL REVENUES. Table 4, 1985-88 PROJECTED OTHER NON-FUEL REVENUES, lists the revenue by the individual and total other non-fuel revenue accounts for the 38 vehicle classes used in the study. Table 5 is similar to Table 4 but shows the attributed other non-fuel revenues by various combinations of vehicles. Passenger vehicles contributed 96.59% and trucks 3.41% of the projected $105,501,364 other non-fuel revenues during the four year study period.

ATTRIBUTION OF PROJECTED FUEL REVENUES. Table 6, 1985-1988 PROJECTED FUEL REVENUES, lists the fuel revenues by freeway and highway funds and by the total of freeway and highway funds for the 38 vehicle classes used in the study. Table 7 is similar to Table 6 but shows the attributed revenues by various combinations of vehicles. Passenger vehicles contributed 68.54% and trucks 31.46% of the projected $364,900,000 fuel revenues during the four year study period.

SUMMARY OF ATTRIBUTION OF PROJECTED REVENUES. Table 8, 1985-1988 SUMMARY OF PROJECTED REVENUES, combines the projected motor vehicle registration fees, other non-fuel revenues, and fuel revenues into one table for the 38 vehicle classes used in the study. Table 9 is similar to Table 8 but it shows the combined attributed revenues by various combinations of vehicles. Passenger vehicles contributed 66.84% and trucks 33.16% of the combined $742,401,364 projected revenues.

RATIO OF USER CHARGES PAID TO COST RESPONSIBILITY

Tables 12 and 13, TOTAL KANSAS FUNDS AND FREEWAY DEBT RESPONSIBILITY of the Expenditure Allocation chapter, lists the allocated cost responsibility percentages for all vehicle types and for combinations of vehicle types. These cost responsibility percentages, along with user charges paid percentages from Tables

8 and 9 of this chapter, are compared in Tables 10 and 11, 1985-1988 RATIO OF USER CHARGES PAID TO COST RESPONSIBILITY. The comparison is a ratio of percentages of user charges paid to percentages of cost responsibility. A ratio below 1.00 indicates that a vehicle class is being subsidized by other vehicle classes, and anything above 1.00 indicates that a vehicle is paying more than its share. Passenger vehicles and trucks have ratios of 1.12 and 0.82 respectively. Passenger vehicles are overpaying by 12% and trucks are underpaying by 18%.

Table 12 is similar to Tables 10 and 11 except that it is restricted to only those vehicle classes responsible for at least 1.0% of the expenditures. In addition, it includes the operating Equivalent Single Axle Loading (ESAL), Fuel Efficiency in Miles per Gallon (MPG), and the weighted value of registration fees. These 12 vehicle classes account for 94.90% of cost responsibility and 95.73% of projected revenues. Possible reasons for variations in the ratios of user charges and cost responsibility will be postulated through comparisons of ESAL's, MPG's and weighted registration fees.

Passenger vehicles responsible for at least 1% of cost responsibility include FHWA vehicle types 1, 2 and 9. These consist, respectively, of the Standard Auto, Small Auto and Pickups/Vans. Their overall ratio is 1.12 indicating an overpayment of 15% as a class. However, it is noted that Small Autos are underpaying by 7% and are being subsidized by Standard Autos and Pickups/Vans. The class overpayment of 12% suggests that gasoline tax receipts (most vehicles in this group consume gasoline) are a relatively high proportion of highway user revenues from an overall equity perspective.

The light truck class consisting of FHWA Vehicle Types 10, 11 and 12 consist of 2 axle trucks with 6 tires. The ratio for the class is 1.06 indicating an overpayment of 6% as a class. However, it is noted that the ratio decreases as the weight increases. Within the class, the lighter vehicle groups (FHWA Vehicle Types 10 and 11) are subsidizing the heaviest group (FHWA Vehicle Type 12), which underpays by 2%. The class overpayment of 6% suggests that gasoline tax receipts (most vehicles in this group consume gasoline) are a relatively high proportion of highway user revenues from an overall equity perspective.

The single unit, 3-axle truck (FHWA Vehicle Type 16) has a ratio of 0.68 indicating an underpayment of 32%. As a class, these trucks utilize both gasoline and diesel fuel; therefore, some of the trucks would pay the diesel differential. Typical trucks of this type are dump trucks, garbage trucks, concrete mixer trucks, and vans. The Equivalent Single Axle Loadings (ESAL) of these trucks are higher in comparison to gross vehicle weights than ESAL's for combination unit trucks. For comparison purposes, Table 12 lists ESAL values for various truck types. The single unit, 3-Axle truck (FHWA Vehicle Type 16), with a registered gross vehicle weight of 40,000 to 50,000 pounds, has an ESAL value of 0.70212. A heavier combination unit truck (FHWA Vehicle Type 22), with a registered weight of 50,000 to 60,000 pounds, has a smaller ESAL value of 0.57929. Cost responsibility increases with an increase in ESAL values. Kansas weight registration fees are by gross vehicle weight only without regard to vehicle and axle configuration. The underpayment of 32% suggests that weight registration fees based on gross vehicle weights only may subsidize heavy single unit trucks at the expense of combination unit trucks.

The typical truck, if there is such, is FHWA Vehicle Type 30, a combination unit with a 3-axle tractor and a 2-axle trailer, and is commonly referred to as an 18-wheeler. Its registered gross vehicle weight exceeds 75,000 pounds. Its user charges paid to cost responsibility is 0.89 indicating an underpayment of 11%. These trucks generally use diesel fuel and would pay the 2 cent diesel differential fuel tax. This would suggest that diesel tax receipts are a relatively low proportion of highway user revenues from an overall equity perspective.

FHWA Vehicle Type 29, also a 3-axle tractor with a 2-axle trailer but with a registered gross vehicle weight of 70,000 to 75,000 pounds, has a user charge paid to cost responsibility ratio of 0.42 indicating an underpayment of 58%. This extreme variation from the 11% underpayment of the heavier FHWA Vehicle Type 30 is due to carrying a higher proportion of loads at the upper end (75,000 pounds) of its registered gross vehicle weight range, than is carried by Type 30 at its upper end (85,000 pounds). This is apparent from a comparison of ESAL values. The ESAL values for Types 29 and 30 are 1.01456 and 1.03362 respectively.

FHWA Vehicle Type 34, a 5-axle combination unit registered in excess of 75,000 pounds, includes the twin trailers authorized by the 1982 Surface Transportation Assistance Act. Typical trucks of this type include box vans used for hauling general commodities, and hoppers used for hauling grain. The user charges paid to cost responsibility ratio is 0.45 indicating an underpayment of 55%. The twin trailers have a much higher ESAL value than FHWA Vehicle Type 30, the 3-axle tractor with tandem axle trailer. The respective values are 1.17930 and 1.03362. The higher ESAL value substantially increases cost responsibility. This suggests that weight registration fees based on gross vehicle weights may subsidize twin trailer units at the expense of the conventional 18-wheelers.

TABLE 1

PROJECTED 1985-1988 REVENUES
FOR FREEWAY AND HIGHWAY FUNDS

SOURCE	AMOUNT
Motor Vehicle Registration Fees and Titles	$200,400,000
Motor Carrier Inspection and Regulation Fees	5,440,000
International Registration Plan and Prorate Fees	62,960,000
Dealer and Reciprocity Fees	3,200,000
Subtotal Motor Vehicle Registration Revenues	$272,000,000
Driver License Fees	$ 10,400,000
Sales Tax Transfer	83,000,000
Special Vehicle Permit Fees	1,440,432
Miscellaneous Income	10,660,932
Subtotal Other Non-Fuel Revenues	$105,501,364
Freeway Fund Fuel Revenue	$ 67,170,000
Highway Fund Fuel Revenue	297,730,000
Subtotal Fuel Revenues	$364,900,000
Grand Total Projected Revenues	$742,401,000

NOTE: The 1985-1988 allocated expenditures are $988,658,000. The deficit of $256,256,636 will be satisfied by a $191,747,000 Balance Drawdown and $54,509,636 Transfer from the Freeway Fund.

TABLE 2

PROJECTED 1985-1988 MOTOR VEHICLE REGISTRATION REVENUES
ALL VEHICLE TYPES

	FHWA VEHICLE TYPE	1985-88 MO. VEH. REG. FEES AND TITLES	1985-88 MO. CARRIER INSP. AND REG. FEES	1985-88 IRP AND PRORATE FEES	1985-88 DEALER AND RECIP. FEE	1985-88 TOTAL MOTOR VEHICLE REG. REVENUES	1985-88 PERCENT MOTOR VEHICLE REG. REVENUES
1	Standard Auto	$ 65,894,585	$ 0	$ 0	$1,380,877	$ 67,275,462	24.73%
2	Small Auto	26,477,457	0	0	713,568	27,191,025	10.00
3	Motorcycle	4,161,238	0	0	144,908	4,306,146	1.58
4	Intercity Bus	25,982	19	217	164	26,383	0.01
5	Transit Bus	1,501	0	0	147	1,648	0.00
6	School Bus	111,216	0	0	10,444	121,660	0.04
7	SU-4T <6	0	0	0	0	0	0.00
8	SU-4T 6-10	0	0	0	0	0	0.00
9	SU-4T >10	44,547,438	0	0	742,845	45,290,283	16.65
10	SU-6T <19.5	6,960,355	2,240	25,924	76,374	7,064,893	2.60
11	SU-6T 19.5-26	11,503,734	8,588	99,389	78,691	11,690,402	4.30
12	SU-6T >26	3,835,105	3,195	36,977	6,963	3,882,241	1.43
13	SU-3AX <26	328,432	7	83	2,193	330,715	0.12
14	SU-3AX 26-33	882,534	230	2,664	1,345	886,772	0.33
15	SU-3AX 33-40	498,274	133	1,542	651	500,600	0.18
16	SU-3AX 40-50	4,091,189	6,617	76,578	4,632	4,179,015	1.54
17	SU-3AX >50	0	0	0	0	0	0.00
18	CU-3AX <26	0	0	0	0	0	0.00
19	CU-3AX 26-50	2,106,645	1,761	20,380	3,312	2,132,099	0.78
20	CU-3AX >50	242,454	18	212	553	243,238	0.09
21	CU-2S2 <50	370,926	76	884	454	372,340	0.14
22	CU-2S2 50-60	8,267,528	30,278	350,426	18,830	8,667,061	3.19
23	CU-2S2 >60	307,164	54	626	184	308,029	0.11
24	CU-4AX <50	37,753	1	11	46	37,811	0.01
25	CU-4AX 50-60	815,495	277	3,203	1,858	820,833	0.30
26	CU-4AX >60	17,892	1	11	10	17,914	0.01
27	CU-3S2 <50	6,376	0	1	7	6,384	0.00
28	CU-3S2 50-70	3,003,552	7,457	86,308	5,277	3,102,595	1.14
29	CU-3S2 70-75	1,983,856	48,736	564,042	808	2,597,442	0.95
30	CU-3S2 >75	12,198,531	5,305,001	61,397,586	3,809	78,904,928	29.01
31	CU-5AX <50	0	0	0	0	0	0.00
32	CU-5AX 50-70	226,441	33	377	396	227,246	0.08
33	CU-5AX 70-75	133,891	196	2,269	53	136,410	0.05
34	CU-5AX >75	794,382	20,346	235,480	248	1,050,456	0.39
35	CU-6+AX <50	0	0	0	0	0	0.00
36	CU-6+AX 50-70	117,569	8	91	206	117,874	0.04
37	CU-6+AX 70-75	75,514	55	633	30	76,232	0.03
38	CU-6+AX >75	374,989	4,673	54,086	117	433,865	0.16
	Totals	$200,400,000	$5,440,000	$62,960,000	$3,200,000	$272,000,000	100.00%

TABLE 3

PROJECTED 1985-1988 MOTOR VEHICLE REGISTRATION REVENUES
COMBINED VEHICLE TYPES

FHWA VEHICLE TYPE	1985-88 MO. VEH. REG. FEES	1985-88 MO. CARRIER INSP. AND REG. FEES	1985-88 IRP AND PRORATE FEES	1985-88 DEALER AND RECIP. FEES	1985-88 TOTAL MOTOR VEHICLE REG. REVENUES	1985-88 PERCENT MOTOR VEHICLE REG. REVENUES
1 Large Autos	$ 65,894,585	$ 0	$ 0	$1,380,877	$ 67,275,462	24.73%
2 Small Autos	26,477,457	0	0	713,568	27,191,025	10.00
3 Motorcycles	4,161,238	0	0	144,908	4,306,146	1.58
4 Intercity Buses	25,982	19	217	164	26,383	0.01
5 Other Buses	112,717	0	0	10,591	123,308	0.05
6 Pickups/Vans	44,547,438	0	0	742,845	45,290,283	16.65
7 SU Trucks <26	18,792,522	10,835	125,396	157,258	19,086,011	7.02
8 SU Trucks >26	9,307,102	10,175	117,760	13,591	9,448,628	3.47
9 CU Trucks <50	2,521,700	1,838	21,276	3,819	2,548,633	0.94
10 CU Trucks 50-70	12,998,095	38,126	441,255	27,314	13,504,790	4.96
11 CU Trucks 70-75	2,193,261	48,986	566,945	891	2,810,083	1.03
12 CU Trucks >75	13,367,903	5,330,021	61,687,152	4,174	80,389,249	29.55
Totals	$200,400,000	$5,440,000	$62,960,000	$3,200,000	$272,000,000	100.00%

1 Autos	$ 92,372,042	$ 0	$ 0	$2,094,445	$ 94,466,487	34.73%
2 Motorcycles	4,161,238	0	0	144,908	4,306,146	1.58
3 Buses	138,700	19	217	10,755	149,691	0.06
4 Pickups/Vans	44,547,438	0	0	742,845	45,290,283	16.65
5 SU Trucks	28,099,624	21,010	243,156	170,849	28,534,638	10.49
6 CU Trucks	31,080,959	5,418,972	62,716,627	36,198	99,252,755	36.49
Totals	$200,400,000	$5,440,000	$62,960,000	$2,300,000	$272,000,000	100.00%

1 Pass. Vehicles	$141,219,418	$ 19	$ 217	$2,992,953	$144,212,607	53.02%
2 Trucks	59,180,582	5,439,981	62,959,783	207,047	127,787,393	46.98
Totals	$200,400,000	$5,440,000	$62,960,000	$2,300,000	$272,000,000	100.00%

TABLE 4

PROJECTED 1985-1988 OTHER NON-FUEL REVENUES
ALL VEHICLE TYPES

	FHWA VEHICLE TYPE	1985-88 DRIVER LICENSE FEES	1985-88 SALES TAX TRANSFER FEES	1985-88 SP. VEH. PERMITS FEES	1985-88 MISC. INCOME FEES	1985-88 TOTAL OTHER NON-FUEL FEES	1985-88 TOTAL OTHER NON-FUEL PERCENT
1	Standard Auto	$ 4,487,849	$38,046,113	$ 0	$ 4,600,447	$ 47,134,409	44.68%
2	Small Auto	2,319,098	19,660,343	0	2,377,283	24,356,724	23.09
3	Motorcycle	470,950	3,992,516	0	482,766	4,946,231	4.69
4	Intercity Bus	534	626	0	547	1,707	0.00
5	Transit Bus	477	4,047	0	489	5,014	0.00
6	School Bus	33,943	39,827	0	34,794	108,564	0.10
7	SU-4T <6	0	0	0	0	0	0.00
8	SU-4T 6-10	0	0	0	0	0	0.00
9	SU-4T >10	2,414,247	20,466,981	0	2,474,820	25,356,047	24.03
10	SU-6T <19.5	248,215	291,242	0	254,443	793,900	0.75
11	SU-6T 19.5-26	255,746	300,078	0	262,163	817,987	0.78
12	SU-6T >26	22,630	26,553	0	23,198	72,381	0.07
13	SU-3AX <26	7,128	8,364	0	7,307	22,800	0.02
14	SU-3AX 26-33	4,372	5,129	0	4,481	13,982	0.01
15	SU-3AX 33-40	2,116	2,482	0	2,169	6,767	0.01
16	SU-3AX 40-50	15,052	17,662	0	15,430	48,144	0.05
17	SU-3AX >50	0	0	0	0	0	0.00
18	CU-3AX <26	0	0	0	0	0	0.00
19	CU-3AX 26-50	10,765	12,631	0	11,035	34,431	0.03
20	CU-3AX >50	1,797	2,109	0	1,842	5,749	0.01
21	CU-2S2 <50	1,474	1,730	0	1,511	4,716	0.00
22	CU-2S2 50-60	61,197	71,805	0	62,733	195,735	0.19
23	CU-S2S >60	599	703	0	614	1,916	0.00
24	CU-4AX <50	150	176	0	154	479	0.00
25	CU-4AX 50-60	6,038	7,084	0	6,189	19,312	0.02
26	CU-4AX >60	33	38	0	34	105	0.00
27	CU-3S2 <50	23	27	0	24	75	0.00
28	CU-3S2 50-70	17,149	20,122	0	17,580	54,851	0.05
29	CU-3S2 70-75	2,626	3,081	0	2,692	8,398	0.01
30	CU-3S2 >75	12,380	14,526	1,314,680	12,690	1,354,276	1.28
31	CU-5AX <50	0	0	0	0	0	0.00
32	CU-5AX 50-70	1,287	1,510	0	1,319	4,117	0.00
33	CU-5AX 70-75	173	203	0	178	554	0.00
34	CU-5AX >75	805	945	85,491	825	88,066	0.08
35	CU-6+AX <50	0	0	0	0	0	0.00
36	CU-6+AX 50-70	669	785	0	686	2,141	0.00
37	CU-6+AX 70-75	98	115	0	101	314	0.00
38	CU-6+AX >75	379	445	40,261	389	41,473	0.04
	Totals	$10,400,000	$83,000,000	$1,440,432	$10,660,932	$105,501,364	100.00%

TABLE 5

PROJECTED 1985-1988 OTHER NON-FUEL REVENUES
COMBINED VEHICLE TYPES

FHWA VEHICLE TYPE	1985-88 DRIVER LICENSE FEES	1985-88 SALES TAX TRANSFER FEES	1985-88 SP. VEH. PERMITS FEES	1985-88 MISC. INCOME FEES	1985-88 TOTAL OTHER NON-FUEL FEES	1985-88 TOTAL NON-FUEL PERCENT
1 Large Autos	$ 4,487,849	$38,046,113	$ 0	$ 4,600,447	$ 47,134,409	44.68%
2 Small Autos	2,319,098	19,660,343	0	2,377,283	24,356,724	23.09
3 Motorcycles	470,950	3,992,516	0	482,766	4,946,231	4.69
4 Intercity Buses	534	626	0	547	1,707	0.00
5 Other Buses	34,420	43,874	0	35,284	113,578	0.11
6 Pickups/Vans	2,414,247	20,466,981	0	2,474,820	25,356,047	24.03
7 SU Trucks <26	511,090	599,684	0	523,913	1,634,686	1.55
8 SU Trucks >26	44,170	51,826	0	45,278	141,274	0.13
9 CU Trucks <50	12,413	14,564	0	12,724	39,701	0.04
10 CU Trucks 50-70	88,770	104,158	0	90,997	283,925	0.27
11 CU Trucks 70-75	2,897	3,399	0	2,970	9,267	0.01
12 CU Trucks >75	13,564	15,915	1,440,432	13,904	1,483,816	1.41
Totals	$10,400,000	$83,000,000	$1,440,432	$10,660,932	$105,501,364	100.00%

1 Autos	$ 6,806,946	$57,706,456	$ 0	$ 6,977,730	$ 71,491,133	67.67%
2 Motorcycles	470,950	3,992,516	0	482,766	4,946,231	4.69
3 Buses	34,954	44,500	0	35,831	115,285	0.11
4 Pickups/Vans	2,414,247	20,466,981	0	2,474,820	25,356,047	24.03
5 SU Trucks	555,259	651,511	0	569,190	1,775,960	1.68
6 CU Trucks	117,644	138,037	1,440,432	120,595	1,816,708	1.72
Totals	$10,400,000	$83,000,000	$1,440,432	$10,660,932	$105,501,364	100.00%

1 Pass. Vehicles	$ 9,727,097	$82,210,453	$ 0	$ 9,971,146	$101,908,696	96.59%
2 Trucks	672,903	789,547	1,440,432	689,786	3,592,668	3.41
Totals	$10,400,000	$83,000,000	$1,440,432	$10,660,932	$105,501,364	100.00%

TABLE 6

PROJECTED 1985-1988 FUEL REVENUES
ALL VEHICLE TYPES

FHWA VEHICLE TYPE	1985-88 FREEWAY FUND FUEL FEES	1985-88 HIGHWAY FUND FUEL FEES	1985-88 TOTAL FUEL FEES	1985-88 TOTAL FUEL FEES PERCENT
1 Standard Auto	$21,983,112	$ 97,439,810	$119,422,922	32.73%
2 Small Auto	7,338,947	32,529,769	39,868,716	10.93
3 Motorcycle	159,592	707,390	866,983	0.24
4 Intercity Bus	117,011	518,649	635,660	0.17
5 Transit Bus	85,387	378,475	463,862	0.13
6 School Bus	330,218	1,463,686	1,793,904	0.40
7 SU-4T <6	0	0	0	0.00
8 SU-4T 6-10	0	0	0	0.00
9 SU-4T >10	16,027,263	71,040,597	87,067,860	23.86
10 SU-6T <19.5	1,545,360	6,849,785	8,395,145	2.30
11 SU-6T 19.5-26	2,036,494	9,026,729	11,063,223	3.03
12 SU-6T >26	792,511	3,512,792	4,305,303	1.18
13 SU-3AX <26	67,030	297,109	364,139	0.10
14 SU-3AX 26-33	261,231	1,157,903	1,419,135	0.39
15 SU-3AX 33-40	239,666	1,062,317	1,301,984	0.36
16 SU-3AX 40-50	1,702,080	7,544,446	9,246,526	2.53
17 SU-3AX >50	0	0	0	0.00
18 CU-3AX <26	0	0	0	0.00
19 CU-3AX 26-50	865,133	3,834,690	4,699,823	1.29
20 CU-3AX >50	26,295	116,553	142,849	0.04
21 CU-2S2 <50	222,863	987,839	1,210,702	0.33
22 CU-2S2 50-60	1,312,530	5,817,770	7,130,300	1.95
23 CU-2S2 >60	31,556	139,873	171,429	0.05
24 CU-4AX <50	20,315	90,048	110,364	0.03
25 CU-4AX 50-60	120,513	534,173	654,686	0.18
26 CU-4AX >60	3,302	14,637	17,939	0.00
27 CU-3S2 <50	7,741	34,311	42,052	0.01
28 CU-3S2 50-70	449,972	1,994,494	2,444,466	0.67
29 CU-3S2 70-75	2,087,871	9,254,455	11,342,325	3.11
30 CU-3S2 >75	8,365,364	37,079,346	45,444,710	12.45
31 CU-5AX <50	439	1,947	2,386	0.00
32 CU-5AX 50-70	27,108	120,155	147,263	0.04
33 CU-5AX 70-75	130,869	580,073	710,942	0.19
34 CU-5AX >75	490,968	2,176,208	2,667,176	0.73
35 CU-6+AX <50	202	893	1,095	0.00
36 CU-6+AX 50-70	13,437	59,560	72,997	0.02
37 CU-6+AX 70-75	61,361	271,983	333,344	0.09
38 CU-6+AX >75	246,258	1,091,535	1,337,793	0.37
Totals	$67,170,000	$297,730,000	$364,900,000	100.00%

TABLE 7

PROJECTED 1985-1988 FUEL REVENUES
COMBINED VEHICLE TYPES

FHWA VEHICLE TYPE	1985-88 FREEWAY FUND FUEL FEES	1985-88 HIGHWAY FUND FUEL FEES	1985-88 TOTAL FUEL FEES	1985-88 TOTAL FUEL FEES PERCENT
1 Large Autos	$21,983,112	$ 97,439,810	$119,422,922	32.73%
2 Small Autos	7,338,947	32,529,769	39,868,716	10.93
3 Motorcycles	159,592	707,390	866,983	0.34
4 Intercity Buses	117,011	518,649	635,660	0.17
5 Other Buses	415,605	1,842,161	2,257,765	0.62
6 Pickups/Vans	16,027,263	71,040,597	87,067,860	23.86
7 SU Trucks <26	3,648,884	16,173,622	19,822,506	5.43
8 SU Trucks >26	2,995,489	13,277,459	16,272,947	4.46
9 CU Trucks <50	1,116,694	4,949,728	6,066,422	1.66
10 CU Trucks 50-70	1,984,714	8,797,214	10,781,928	2.95
11 CU Trucks 70-75	2,280,100	10,106,510	12,386,611	3.39
12 CU Trucks >75	9,102,590	40,347,090	49,449,679	13.55
Totals	$67,170,000	$297,730,000	$364,900,000	100.00%
1 Autos	$29,322,059	$129,969,579	$159,291,638	43.65%
2 Motorcycles	159,592	707,390	866,983	0.24
3 Buses	532,616	2,360,810	2,893,426	0.79
4 Pickups/Vans	16,027,263	71,040,597	87,067,860	23.86
5 SU Trucks	6,644,373	29,451,081	36,095,454	9.89
6 CU Trucks	14,484,098	64,200,543	78,684,641	21.56
Totals	$67,170,000	$297,730,000	$364,900,000	100.00%
1 Pass. Vehicles	$46,041,529	$204,078,376	$250,119,906	68.54%
2 Trucks	21,128,471	93,651,624	114,780,094	31.46
Totals	$67,170,000	$297,730,000	$364,900,000	100.00%

TABLE 8

SUMMARY OF PROJECTED 1985-88 REVENUES
ALL VEHICLE TYPES

FHWA VEHICLE TYPE	1985-88 TOTAL MOTOR VEHICLE REG. REVENUES	1985-88 TOTAL OTHER NON-FUEL REVENUES	1985-88 TOTAL FUEL REVENUES	1985-88 TOTAL REVENUES DOLLARS	1985-88 TOTAL REVENUES PERCENT
1 Standard Auto	$ 67,275,462	$ 47,134,409	$119,422,922	$233,832,793	31.50%
2 Small Auto	27,191,025	24,356,724	39,868,716	91,416,465	12.31
3 Motorcycle	4,306,146	4,946,231	866,983	10,119,360	1.36
4 Intercity Bus	26,383	1,707	635,660	663,749	0.09
5 Transit Bus	1,648	5,014	463,862	470,524	0.06
6 School Bus	121,660	108,564	1,793,904	2,024,128	0.26
7 SU-4T <6	0	0	0	0	0.00
8 SU-4T 6-10	0	0	0	0	0.00
9 SU-4T >10	45,290,283	25,356,047	87,067,860	157,714,190	21.24
10 SU-6T <19.5	7,064,893	793,900	8,395,145	16,253,937	2.19
11 SU-6T 19.5-26	11,690,402	817,987	11,063,223	23,571,612	3.18
12 SU-6T >26	3,882,241	72,381	4,305,303	8,259,924	1.11
13 SU-3AX <26	330,715	22,800	364,139	717,654	0.10
14 SU-3AX 26-33	886,772	13,982	1,419,135	2,319,889	0.31
15 SU-3AX 33-40	500,600	6,767	1,301,984	1,809,350	0.24
16 SU-3AX 40-50	4,179,015	48,144	9,246,526	13,473,685	1.81
17 SU-3AX >50	0	0	0	0	0.00
18 CU-3AX <26	0	0	0	0	0.00
19 CU-3AX 26-50	2,132,099	34,431	4,699,823	6,866,353	0.92
20 CU-3AX >50	243,238	5,749	142,849	391,835	0.50
21 CU-2S2 <50	372,340	4,716	1,210,702	1,587,758	0.21
22 CU-2S2 50-60	8,667,061	195,735	7,130,300	15,993,097	2.15
23 CU-2S2 >60	308,029	1,916	171,429	481,374	0.06
24 CU-4AX <50	37,811	479	110,364	148,654	0.02
25 CU-4AX 50-60	820,833	19,312	654,686	1,494,831	0.20
26 CU-4AX >60	17,914	105	17,939	35,958	0.00
27 CU-3S2 <50	6,384	75	42,052	48,510	0.01
28 CU-3S2 50-70	3,102,595	54,851	2,444,466	5,601,911	0.75
29 CU-3S2 70-75	2,597,442	8,398	11,342,325	13,948,165	1.88
30 CU-3S2 >75	78,904,928	1,354,276	45,444,710	125,703,914	16.93
31 CU-5AX <50	0	0	2,386	2,386	0.00
32 CU-5AX 50-70	227,246	4,117	147,263	378,626	0.05
33 CU-5AX 70-75	136,410	554	710,942	847,905	0.11
34 CU-5AX >75	1,050,456	88,066	2,667,176	3,805,698	0.51
35 CU-6+AX <50	0	0	1,095	1,095	0.00
36 CU-6+AX 50-70	117,874	2,141	72,997	193,011	0.03
37 CU-6+AX 70-75	76,232	314	333,344	408,890	0.06
38 CU-6+AX >75	433,865	41,473	1,337,793	1,813,131	0.24
Totals	$272,000,000	$105,501,364	$364,900,000	$742,401,364	100.00%

TABLE 9

SUMMARY OF PROJECTED 1985-88 REVENUES
COMBINED VEHICLE TYPES

FHWA VEHICLE TYPE	1985-88 TOTAL MOTOR VEHICLE REG. REVENUES	1985-88 TOTAL OTHER NON-FUEL REVENUES	1985-88 TOTAL FUEL REVENUES	1985-88 TOTAL REVENUES DOLLARS	1985-88 TOTAL REVENUES PERCENT
1 Large Autos	$ 67,275,462	$ 47,134,409	$119,422,922	$233,832,793	31.50%
2 Small Autos	27,191,025	24,356,724	39,868,716	91,416,465	12.31
3 Motorcycles	4,306,146	4,946,231	866,983	10,119,360	1.36
4 Intercity Buses	26,383	1,707	635,660	633,749	0.09
5 Other Buses	123,308	113,578	2,257,765	2,494,651	0.34
6 Pickups/Vans	45,290,283	25,356,047	87,067,860	157,714,190	21.24
7 SU Trucks <26	19,086,011	1,634,686	19,822,506	40,543,204	5.46
8 SU Trucks >26	9,448,628	141,274	16,272,947	25,862,849	3.48
9 CU Trucks <50	2,548,633	39,701	6,066,422	8,654,757	1.17
10 CU Trucks 50-70	13,504,790	283,925	10,781,928	24,570,643	3.31
11 CU Trucks 70-75	2,810,083	9,267	12,386,611	15,205,961	2.05
12 CU Trucks >75	80,389,249	1,483,816	49,449,679	131,322,743	17.69
Totals	$272,000,000	$105,501,364	$364,900,000	$742,401,364	100.00%
1 Autos	$ 94,466,487	$ 71,491,133	$159,291,638	$325,249,257	43.81%
2 Motorcycles	4,306,146	4,946,231	866,983	10,119.360	1.36
3 Buses	149,691	115,285	2,893,426	3,158,401	0.43
4 Pickups/Vans	45,290,283	25,356,047	87,067,860	157,714,190	21.24
5 SU Trucks	28,534,638	1,775,960	36,095,454	66,406,052	8.94
6 CU Trucks	99,252,755	1,816,708	78,684,641	179,754,104	24.21
Totals	$272,000,000	$105,501,364	$364,900,000	$742,401,364	100.00%
1 Passenger Vehicles	$144,212,607	$101,908,696	$250,119,906	$496,241,208	66.84%
2 Trucks	127,787,393	3,592,668	114,780,094	246,160,156	33.16
Totals	$272,000,000	$105,501,364	$364,900,000	$742,401,364	100.00%

TABLE 10

RATIO OF 1985-88 USER CHARGES PAID TO COST RESPONSIBILITY
ALL VEHICLE TYPES

FHWA VEHICLE TYPE	COST RESPONSIBILITY PERCENT	USER CHARGES PAID PERCENT	RATIO OF USER CHARGES PAID TO COST RESPONSIBILITY
1 Standard Auto	25.77%	31.50%	1.22
2 Small Auto	13.25	12.31	0.93
3 Motorcycle	0.72	1.36	1.89
4 Intercity Bus	0.12	0.09	0.73
5 Transit Bus	0.05	0.06	1.21
6 School Bus	0.68	0.27	0.40
7 SU-4T <6	0.00	0.00	0.00
8 SU-4T 6-10	0.00	0.00	0.00
9 SU-4T >10	19.13	21.24	1.11
10 SU-6T <19.5	2.00	2.19	1.10
11 SU-6T 19.5-26	2.96	3.18	1.07
12 SU-6T >26	1.13	1.11	0.98
13 SU-3AX <26	0.10	0.10	1.02
14 SU-3AX 26-33	0.43	0.31	0.73
15 SU-3AX 33-40	0.36	0.24	0.68
16 SU-3AX 40-50	2.69	1.81	0.68
17 SU-3AX >50	0.00	0.00	0.00
18 CU-3AX <26	0.00	0.00	0.00
19 CU-3AX 26-50	1.24	0.92	0.74
20 CU-3AX >50	0.04	0.05	1.29
21 CU-2S2 >50	0.28	0.21	0.77
22 CU-2S2 50-60	2.13	2.15	1.01
23 CU-2S2 >60	0.06	0.06	1.09
24 CU-4AX <50	0.03	0.02	0.77
25 CU-4AX 50-60	0.22	0.20	0.94
26 CU-4AX >60	0.01	0.004843	0.92
27 CU-3S2 <50	0.01	0.01	0.56
28 CU-3S2 50-70	0.94	0.75	0.81
29 CU-3S2 70-75	4.47	1.88	0.42
30 CU-3S2 >75	18.98	16.93	0.89
31 CU-5AX <50	0.000586	0.000321	0.55
32 CU-5AX 50-70	0.04	0.05	1.26
33 CU-5AX 70-75	0.27	0.11	0.42
34 CU-5AX >75	1.14	0.51	0.45
35 CU-6+AX <50	0.000343	0.000147	0.43
36 CU-6+AX 50-70	0.02	0.03	1.16
37 CU-6+AX 70-75	0.15	0.06	0.37
38 CU-6+AX >75	0.58	0.24	0.42
Totals	100.00%	100.00%	1.00

TABLE 11

RATIO OF 1985-88 USER CHARGES PAID TO COST RESPONSIBILITY
COMBINED VEHICLE TYPES

FHWA VEHICLE TYPE	COST RESPONSIBILITY PERCENT	USER CHARGES PAID PERCENT	RATIO OF USER CHARGES PAID TO COST RESPONSIBILITY
1 Large Autos	25.77%	31.50%	1.22
2 Small Autos	13.25	12.31	0.93
3 Motorcycles	0.72	1.36	1.89
4 Intercity Buses	0.12	0.09	0.73
5 Other Buses	0.73	0.34	0.46
6 Pickups/Vans	19.13	21.24	1.11
7 SU Trucks <26	5.05	5.46	1.08
8 SU Trucks >26	4.61	3.48	0.76
9 CU Trucks <50	1.56	1.17	0.75
10 CU Trucks 50-70	3.45	3.31	0.96
11 CU Trucks 70-75	4.90	2.05	0.42
12 CU Trucks >75	20.71	17.69	0.85
Totals	100.00%	100.00%	1.00
1 Autos	39.02%	43.81%	1.12
2 Motorcycles	0.72	1.36	1.89
3 Buses	0.85	0.43	0.50
4 Pickups/Vans	19.13	21.24	1.11
5 SU Trucks	9.66	8.94	0.93
6 CU Trucks	30.62	24.21	0.79
Totals	100.00%	100.00%	1.00
1 Pass. Vehicles	59.72%	66.84%	1.12
2 Trucks	40.28	33.16	0.82
Totals	100.00%	100.00%	1.00

TABLE 12

RATIO OF 1985-88 USER CHARGES PAID TO COST RESPONSIBILITY
SELECTED VEHICLE TYPES
(RESPONSIBLE FOR AT LEAST 1% OF COST RESPONSIBILITY)

	FHWA VEHICLE TYPE	KS 1982 FLEX PVMT OPERATING ESAL	KS 1986 COMBINED FUEL MPG	KS 1985 WEIGHTED REGIS FEE	COST RESPON-SIBILITY PERCENT	USER CHARGES PAID PERCENT	RATIO OF USER CHARGES PAID TO COST RESPON-SIBILITY
	PASSENGER VEHICLES						
1	Standard Auto	0.00012	15.26	$ 17.81	25.79%	31.50%	1.22
2	Small Auto	0.00010	24.92	13.48	13.25	12.31	0.93
9	SU-4T >10	0.02140	13.50	25.16	19.13	21.24	1.11
	Subtotal				58.15	65.05	1.12
	LIGHT TRUCKS						
10	SU-6T >19.5	0.04340	6.78	32.26	2.00	2.19	1.10
11	SU-6T 19.5-26	0.23790	6.22	57.48	2.96	3.18	1.07
12	SU-6T >26	0.31930	5.66	210.72	1.13	1.11	0.98
	Subtotal				6.09	6.48	1.06
	SINGLE UNIT - 3 AXLES TRUCKS						
16	SU-3AX 40-50	0.70212	4.96	340.80	2.69	1.81	0.68
	COMBINATION UNIT - 3 AXLES TRACTORS-SEMITRAILER						
19	CU-3AX 26-50	0.38060	5.41	240.94	1.24	0.92	0.74
	COMBINATION UNIT - 4 AXLES TRACTOR-SEMITRAILER						
22	SU-2S2 50-60	0.57929	5.42	155.25	2.13	2.15	1.01
	COMBINATION UNIT - 5 AXLES TRACTOR-SEMITRAILER						
29	CU-3S2 70-75	1.01456	5.57	959.79	4.47	1.88	0.42
30	CU-3S2 >75	1.03362	5.55	1,242.05	18.98	16.93	0.89
	Subtotal				23.46	18.81	0.80
	COMBINATION UNIT - 5 AXLES TRACTOR-TWIN TRAILERS						
34	CU-5AX >75	1.17930	5.58	1,243.41	1.14	0.51	0.45
	Totals				94.90%	95.75%	1.01

end of Chapter 4 blank on purpose

APPENDIX A
BASIC ROAD AND VEHICLE ISSUES

For purposes of the Kansas Highway Cost Allocation Study, a basic service road is one which would adequately accommodate the smallest reasonable number of vehicles of the smallest reasonable size or weight. The costs of the basic service roadway would be the responsibility of the basic vehicles as well as all other vehicles using the facility. A full service road would have additional width and strength as required to provide service to wider and heavier vehicles. The wider and heavier vehicles would be responsible for the additional costs required to convert a basic service road to a full service road.

ELEMENTS OF GEOMETRIC DESIGN

A discussion of the relationships between roadway geometric design features and related vehicle characteristics, together with an evaluation of the magnitude of the effect of each related vehicle characteristic and vehicle class on specific design features, is necessary before determining the features of a basic road.

SIGHT DISTANCE

Stopping sight distance is dependent on the driver's visibility of an object on the road and the time required to perceive the object and brake the vehicle before reaching the object. Current criteria have been derived directly from passenger car operation. Design policy specifies provision of additional stopping sight distance for larger classes of vehicles where there are horizontal sight restrictions, particularly on downgrades.

Intersection sight distance must be provided at intersections to allow drivers to adjust speed or stop or to enable stopped vehicles to safely cross the highway. The deceleration/acceleration characteristics of a vehicle and its overall length are directly related to intersection sight distance.

Passing sight distance is determined on the basis of the length needed to safely complete a normal passing maneuver. As with stopping sight distance, minimum passing sight distance has been primarily established from passenger car operation. Although it is obvious that larger classes of vehicles would affect passing sight distance by the length of vehicle to be passed and lesser acceleration capability, the relationship is minimal and is not reflected in present design practice. The frequency and provision of passing sight distance varies with classification of highway and applies only to 2-lane facilities.

HORIZONTAL ALIGNMENT

Superelevation is provided on horizontal curves to counteract a portion of the centrifugal force generated by vehicles traversing the curve. The higher center of gravity of larger classes of vehicles (possibly affected by loading) under some circumstances could produce near-to-critical (or overturning) roll moment. Current methods of deriving maximum rates of superelevation, however, are based on either the limiting lateral coefficient of friction or stopped or slow moving vehicles on slick (icy) surfaces, or on the consideration of comfort of vehicle operation. Consideration is not given implicitly to variations among vehicle classes.

Superelevation runoff or the transition between the normal road cross section and the superelevated section bears no apparent relationship to vehicle class.

Degree of curvature, as with superelevation, would apparently be affected by the higher center of gravity of larger classes of vehicles, but present day practice does not directly account for this characteristic.

Horizontal curve transitions have no discernible relationship with vehicle characteristics.

Width of turning roadways, pavement widening on curves and intersection curves are geometric design features affected by the same vehicle characteristics. Vehicle off-tracking and minimum turning radius are a function of wheelbase, and swept width is related to both length and width of the vehicle. The relationship between vehicle characteristics and geometric design is direct and strong for each of these design features.

VERTICAL ALIGNMENT

Maximum grade and critical length of grade are determined by the ability of vehicles to maintain reasonable speed on up-grades which, in turn, is related to the WT/HP ratio of the vehicle. Reductions in speed below acceptable limits result in loss of freedom of operation and unsafe conditions. There is a strong relationship, therefore, between these roadway design features and vehicle class.

Climbing lanes are provided when grades are of sufficient length and steepness that speed reductions by heavier classes of vehicles could impede following vehicles. Climbing lanes are provided on all types of highways to maintain an appropriate level of service, but are most critical on 2-lane facilities and are found mainly on the higher classes of roadway. Climbing lanes serve another purpose in affording a safe passing area on roads with limited sight distance. While there is reason to believe that some climbing lanes would still be provided even if there were no heavier vehicles in the traffic stream, the primary justification for adding a lane on long up-grades to compensate for reduced climbing ability of heavier classes of vehicles.

Emergency escape ramps are installed at appropriate locations on long descending grades for the purpose of slowing and stopping a runaway vehicle away from the main traffic stream. Although it is possible for the escape ramps to be used by all classes of vehicles, the primary reason for providing such a feature is the presence of heavier classes of vehicles in the traffic stream. Emergency escape ramps are not used in Kansas because it is 90% flat and 10% rolling terrain without any mountainous areas.

Vertical curves affect the gradual change between tangent grades. There is no apparent relationship between geometric design of vertical curves and vehicle class.

Vertical clearance is directly related to vehicle height. Sufficient clearance must be provided to allow vehicles to pass safely beneath structures, wires, signs and other overhead obstructions.

CROSS SECTION

Cross slope is provided for pavement drainage and is unrelated to vehicle class.

Crossover break occurs at the pavement edge on superelevated sections and is the algebraic difference between the pavement and shoulder slopes. A maximum crossover break has been specified to avoid hazardous "roll-over" by vehicles leaving the traveled way, but the procedures used to establish this limit were unrelated to vehicle class.

Lane width bears a direct relationship to vehicle width. Lane width standards now in use were developed on the basis of acceptable clearances between meeting or passing vehicles and clearances to the right pavement edge for different classes of vehicles.

Shoulder width is related to vehicle width insofar as one important function of shoulders is to provide space for vehicles to make emergency stops. Shoulder width also affects vehicle placement on the traveled way, and hence, lane width.

Curbs are unrelated to vehicle class except that, primarily in urban areas, the maximum height of curb would be limited to that which could be cleared by an opened vehicle door.

Sideslopes directly impact the larger classes of vehicles due to their height (higher center of gravity).

Traffic barriers, while offering protection to all vehicle classes, are designed with the vehicle mass of larger classes of vehicles in mind.

Medians and median openings are related to vehicle turning characteristics and dimensions and are predicated on the width required to develop a turning lane and the length needed to protect vehicles waiting to turn.

Cul-de-sacs are affected in their design by vehicle length and width, but are an insignificant element of highway design.

Speed change lanes are designed to permit acceleration to the desired openroad speed and to provide maneuvering space for merging with through traffic. Therefore, while the length of acceleration lanes would be somewhat dependent on the acceleration capability and length of vehicles using it, a significant portion of the length is required by all classes of vehicles as a maneuvering area. Although they would vary somewhat, vehicle class is not considered in the criteria established for length of deceleration lanes. The width of speed change lanes is determined in the same manner as that of through traffic lanes.

OTHER FEATURES

Noise attenuation is provided in selected noise-sensitive areas to reduce the adverse impacts of highway noise. Heavier vehicle classes are the primary sources of highway noise, and attenuation is considered to be unique to these classes.

Weigh stations are provided only for trucks and, therefore, are considered to be unique to heavy vehicle classes.

Rest areas serve all classes of vehicles. Except for designation of some parking spaces for trucks, the design of the facilities provided is not related to vehicle class.

Signs and markings bear little relationship to vehicle class except for the height of overhead sign bridges (vehicle height). The mounting height of signs is also related to the height of vehicles which would obstruct the vision of other drivers.

COMPOSITE FEATURES

Some roadway elements such as intersections and interchanges incorporate several of the vehicle class-related design features described above. Design of intersections and at-grade ramp terminals, for example, includes consideration of vehicle turning paths (length, width), storage requirements (length), and sight distance (deceleration/acceleration, length). Interchange design incorporates these characteristics along with vertical clearance (height).

PREVALENCE OF DESIGN FEATURES

Design features are defined as elements of the highway system which would be affected by a change in any of the geometric elements referred to earlier in this report. It is important to assess the prevalence of these features in order to determine the relative impacts which would result from changes in one or more geometric elements.

Of the geometric design elements under consideration, only lane width and shoulder width would affect design features found throughout the entire length of all classes of highways. A change in either of these cross-sectional elements would also affect width of structures and, to a lesser extent, length of overpassing structures.

Geometric features related primarily to vertical alignment, such as maximum grade, critical length of grade, climbing lanes and emergency escape ramps, would primarily affect highways in rolling or mountainous terrain. These features are not critical design parameters in Kansas inasmuch as 90 percent of Kansas terrain is flat with only the remaining ten percent being rolling.

The various features which affect geometric design of intersections and at-grade ramp terminals include intersection sight distance, widths of turning roadways, intersection (turning) curves, and medians and median openings as well as width of lanes and shoulders. Intersections are much more prevalent in urban than in rural areas. There are more intersections on minor arterials and collectors than on higher classes of roadways. There are no intersections on interstate highways. The functional classification, "primary arterial-other," also includes urban freeways and expressways not on the interstate system.

Geometric features affecting interchanges include widths of turning roadways, maximum grade, vertical clearance and speed change lanes as well as widths of lanes and shoulders. In general, there are about three times as many interchanges per mile of highway in urban areas than in rural areas.

Of the remaining geometric features under consideration, provision of increased stopping sight distance for heavier classes of vehicles at the base of downgrades and pavement widening on curves are encountered less frequently than the features cited above.

GEOMETRIC DESIGN FEATURES

The following discussion will cover the design features and general values suitable for use in a basic road previously defined as a road which would adequately accommodate the smallest reasonable number of vehicles of the smallest reasonable size or weight.

STOPPING SIGHT DISTANCE (HORIZONTAL SIGHT RESTRICTION)

Sight distance is the length of highway ahead visible to the driver. The minimum sight distance available on a basic road should be sufficiently long to enable a basic vehicle traveling at or near the likely top speed to stop before reaching an object in its path.

It is assumed that the likely top speed to be considered on the basic road is the posted speed limit. The stopping sight distance will range from 461 to 538 feet with the lower number used on collector roads and the higher number on arterial roadways.

INTERSECTION SIGHT DISTANCE

The operator of a vehicle approaching an intersection at grade should have an unobstructed view of the whole intersection and of a length of the intersecting roadway sufficient to permit control of the vehicle to avoid collisions. The deceleration/acceleration characteristics of a vehicle and its overall length are directly related to intersection sight distance. The minimum unobstructed sight triangle, according to AASHTO, is one with legs extending 220 feet on a highway with 50 mph speed, and 130 feet on a highway with 30 mph speed. These would be absolute minimum values for a two-lane road of any functional classification.

PASSING SIGHT DISTANCE

Basic road passing sight distance is determined for a single vehicle passing a single vehicle, and the driver should see a sufficient distance ahead clear of traffic so that the passing maneuver can be completed, without cutting off the passed vehicle, and before meeting an opposing vehicle which might appear after he started to pass. According to AASHTO, the minimum safe passing distance on a 2-lane highway with a speed group of 40-50 mph is 1460 feet.

SUPERELEVATION

For a given speed the maximum superelevation rate and assumption for maximum side friction factor in combination determine the maximum curvature. The maximum rates of superelevation usable on highways are controlled by several factors: (1) climatic conditions, i.e., frequency and amount of snow and icing; (b) terrain condition, flat vs. mountainous; (c) type of area, i.e., rural or urban; and (d) frequency of very slow moving vehicles that would be subject to uncertain operation. A single maximum superelevation rate is not universally applicable, but the maximum superelevation rate for open highways in common use is in the order of 0.12 foot per foot, and will be used for the basic road. In or near urban areas where top speeds may be reduced, a lower maximum rate of superelevation of 0.06 foot per foot has commonly been used.

SUPERELEVATION RUNOFF

Superelevation runoff is the general term denoting the length of highway needed to accomplish the change in cross slope from a normal crown section to the fully superelevated section, or vice versa. Review of current design practice by AASHTO shows use of minimum runoff lengths in the range of 100 to 250 feet, regardless of width and superelevation. This range will be utilized in the basic road, with the lower number used on collector roads, and the larger number used on arterial roadways.

DEGREE OF CURVE

The maximum degree of curvature, or the minimum radius, is a limiting value for a given design speed determined from the maximum rate of superelevation and the maximum side friction factor. Using a rate of roadway superelevation of 0.12 foot per foot, maximum safe side friction factors derived by AASHTO, and posted speeds as derived in the discussion of stopping sight distance, the maximum degree of curve for various functional classifications ranges from 5.75 degrees to 9 degrees with the lower numbers used on major arterials and the higher numbers used on collector roads.

TRANSITION

Any motor vehicle follows a transition path as it enters or leaves a circular horizontal curve. With moderate speed and curvature the average driver can effect a suitable transition path within the limits of normal lane width. Using the formula for spiral curves to effect a transition to the circular curve and values of speed and degree of curve previously defined, the minimum length of spiral curves ranges from 397 feet to 654 feet with the lower numbers used on urban arterials and the higher numbers used on rural arterials.

WIDTHS OF TURNING ROADWAYS

The required width of turning roadway depends jointly upon the design, size of vehicle and upon the curvature of the turning roadway. For a minimum radius on the inner edge of pavement of 50 feet and for two-lane operation of a basic passenger vehicle, AASHTO specifies a minimum turning roadway width of 26 feet.

PAVEMENT WIDENING ON CURVES

The necessity for pavement widening on open highway curves is a function of the length and width of design vehicle, the degree of curve, the width of pavement, and the design speed. Amount of pavement widening on 22-feet, 2-lane pavements for the maximum degree of curve previously defined ranges from 2.5 to 3 feet with the lower value for arterial roadways and the higher value for collector roads.

INTERSECTION (TURNING) CURVES

A 25-foot radius on the inner edge of pavement is considered the sharpest simple arc that clears the inner wheel path of a passenger vehicle.

MAXIMUM GRADE

Gradability refers to the maximum relative speed achieved by a vehicle on a given length and rate of upgrade. Maximum speeds are reduced as the grade increases in length or steepness. For safety and capacity reasons, speed reductions in excess of 15 mph are considered undesirable and to be avoided whenever possible. This criteria is combined with a maximum assumed weight to horsepower ratio (WT/HP) of 400 (80,000 lb. GVW - 200 hp; 4,000 lb. GVW - 10 hp) for the heaviest and/or least powerful group of vehicles to indicate, for example, that a 1200-foot grade of 3.7 percent is critical for a WT/HP ratio of 400. However, assuming a lowest practical WT/HP ratio of 100 (which would include cars), a 2500-foot grade of 4.5 percent is critical. Applications of those findings indicates that the basic vehicle could drive within an acceptable range of operating speeds on maximum grades of 6 to 7 percent of an unlimited length.

The conclusion is therefore drawn, that a basic road in rolling terrain may have a maximum grade up to 5 percent on the Interstate, 7 percent on primary arterials, and 9 percent on collectors. This determination of maximum grades for the basic road is consistent with AASHTO policy and takes into account overall operations of traffic and the desirability of providing a balanced design compatible with the classification of highway and character of terrain.

CRITICAL LENGTH OF GRADE

For reasons indicated above, the basic vehicle on the above-noted maximum grades is assumed to have no minimum critical length of grade.

CLIMBING LANES

Again, for reasons cited above, the basic vehicle would require no climbing lanes.

EMERGENCY ESCAPE RAMPS

These ramps are installed at appropriate locations on long descending grades for the purpose of slowing and stopping a runaway vehicle away from the main traffic stream. Such ramps would not be used in the rolling terrain of Kansas and are, in any event, primarily provided for heavier classes of vehicles than the basic vehicle.

VERTICAL CURVES

The major control for safe operation on crest vertical curves is the provision of ample sight distances for the design speed. Minimum stopping sight distance should be provided in all cases. The minimum rate of vertical curvature for the basic stopping sight distance, given as length of the curve in feet per percent of algebraic differences in grade ranges from 71 to 206 with the lower values generally in urban areas.

VERTICAL CLEARANCE

According to AASHTO, the clear height of all structures should be at least 14 feet over the entire width of traffic lanes. Kansas law restricts vertical clearance to no less than 13.5 feet. AASHTO permits vertical clearance of 12.5

feet on parkways which are normally used by passenger vehicles only, but these circumstances would occur so seldom in Kansas that it is felt the basic vertical clearance should be 13.5 feet.

CROSS SLOPE

Two-lane and wider pavements on tangents or flat curves have a crown or high point in the middle and slope downward toward both edges. The rate of normal pavement cross-slope, in feet per foot, is a function of surface type, and therefore ranges from 0.02 to 0.04 with the lower values generally in urban areas.

CROSSOVER BREAK

Crossover break occurs at the pavement edge on superelevated sections and is the algebraic difference between the pavement and shoulder slopes. A desirable algebraic difference at a crossover crown line is 0.04 or 0.05 foot per foot, but it may be as high as 0.08 at low speeds.

LANE WIDTH

With the continued upward trend in traffic volumes, vehicle speeds, and width of trucks, main 2-lane highways have been increased from early widths of 16 and 18 feet to present widths of 22 to 26 feet. Ten to 13 foot lane widths now are generally used, with a 12-foot lane width predominant on most high-type highways.

Highway lane width is a function of vehicle width along with some margin of safety required by drivers on either side of the vehicle. Shoulder width is also directly related to vehicle width. Basic vehicles are assumed to represent a class of vehicle having a width of 6.0 feet. Based on derived formulas, the minimum lane width on all rural functional classifications, based on a 6-foot vehicle, is 11 feet. The "basic" urban Interstate lane width is 11', the urban other primary arterial lane width is 10.8', and the urban minor arterial and collector basic lane width is 10.5'. Because of relatively high traffic volumes and numerous conflicts encountered on urban roadways, a basic lane width of 11' is suggested for all roadways.

SHOULDER WIDTH

Shoulders are essential parts of the roadway for safety and for developing the full capacity of the highway, as well as for structural reasons. Based on a basic 6-foot vehicle and expected average daily traffic on various functional classifications, minimum shoulder width is 10.0 feet on arterial roads, and 4.0 feet on collector and local roads. On divided highways having two or three lanes in each direction, a paved shoulder strip at least four feet wide will preclude rutting at the edge of the pavement and will alleviate possible loss of driver control of vehicles that inadvertently encroach on the median.

CURBS

Curbs on the basic roadway would have no limitation other than to limit the maximum height to 6" or 8" so that it could be cleared by an opened vehicle door.

SIDESLOPES

Flat slopes are safer, more stable, and more economic to maintain than steep slopes and the slope, horizontal to vertical, is a function of the height of cut or fill and the type of terrain. Side slopes of 4:1 are considered the maximum desirable for the basic road.

TRAFFIC BARRIERS - ROADSIDE, MEDIAN, CRASH CUSHIONS

Guardrails or guide posts are used where vehicles accidentally leaving the highway would be subjected to undue hazard. Guardrails may generally be omitted on slopes of 4:1 or flatter except at structures. Traffic barriers are generally omitted from the basic road.

MEDIANS AND MEDIAN OPENINGS

A median is provided primarily to separate opposing traffic streams and should be as wide as can be used advantageously. Recommended minimum median widths vary from 4 feet to provide pedestrian refuge to 14 feet to provide space for a median lane and protection of vehicles making left exit turns. The length of median opening should be a minimum of 40 feet.

CUL-DE-SACS

Cul-de-sacs are an insignificant consideration on local streets and are not considered in design of the basic road.

SPEED CHANGE LANES

Acceleration/deceleration lanes should be the same width as the basic lane width of 11 feet. The total length of speed-change lanes on main highways, including taper, is a function of the roadway grade, the design speed of the turning roadway curve, the minimum curve radius, and the design speed of the highway. Minimum lengths under ideal conditions are in the order of 225 feet.

LEISCH STUDY

A supporting document to the 1982 Federal Cost Allocation Study entitled "Synthesis of Information on Roadway Geometrics Causal Factors" was developed by Jack E. Leisch and Associates. The document examined the relationships between roadway design features and vehicle classes in order to attribute the use of roadway design features and their estimated cost to those classes of vehicles that need or are particularly accommodated by each design element. This report defined a practical basic road and practical basic vehicle classes.

VEHICLE PERFORMANCE

Gradability refers to the maximum relative speed achieved by a vehicle on a given length and rate of upgrade. Maximum speeds are reduced as the grade increases in length or steepness. For safety and capacity reasons, speed reductions in excess of 15 mph are considered undesirable and to be avoided whenever possible. This criterion is combined with a maximum assumed weight to horsepower ratio (WT/HP) of 400 (80,000 lb. GVW = 200 hp; 4,000 lb. GVW = 10hp) for the heaviest and/or least powerful group of vehicles to indicate, for example, that a 1200-foot grade of 3.7 percent is critical for a WT/HP ratio of 400. However, assuming a lowest practical WT/HP ratio of 100 (which would include cars), a 2500-foot grade of 4.5 percent is critical. Application of those findings indicates that automobiles (read basic vehicle) could drive within an acceptable range of operating speeds on maximum grades of 6 to 7 percent for an unlimited length.

The conclusion could therefore be drawn that a "basic road" in rolling terrain may have a maximum grade up to 5 percent on the Interstate, 7 percent on primary arterials, 8 percent on minor arterials, and 9 percent on collectors. This determination of maximum grades for the basic road is consistent with AASHTO policy and takes into account overall operations of traffic and the desirability of providing a balanced design compatible with the classification of highway and character of terrain.

VEHICLE WIDTH

Highway lane width is a function of vehicle width along with some margin of safety required by drivers on either side of the vehicle. Shoulder width is also directly related to vehicle width. Passenger cars (read basic vehicle) were assumed to represent a class of vehicle having a width of 6.0 feet and trucks would be representative of vehicles 8.0 feet wide. Based on derived formulas, the minimum lane width on all rural functional classifications, based on a 6-foot vehicle, is 11 feet. The "basic" urban Interstate lane width is 11', the urban other primary arterial lane width is 10.8', and the urban minor arterial and collector basic lane width are 10.5'.

Based on a basic 6.0 vehicle, minimum urban (includes other freeways and expressways) and rural Interstate shoulder width is 10.0 feet, minimum rural other primary arterial shoulder width is 8.5 foot, and minimum rural minor arterial shoulder width is 5.0'. Shoulder width was not considered a function of vehicle width on urban facilities other than freeways and expressways or on rural collector highways; a 4.0 foot shoulder was designated on rural collectors.

VEHICLE HEIGHT

Required vertical clearance is the sum of maximum vehicle height, plus a margin of clearance in excess of vehicle height to allow for future resurfacing of the roadway as well as a slight additional separation for safety and driver satisfaction. AASHTO policy specifies minimum vertical clearance of vehicle height plus 1.5 feet. However, a vertical clearance of 7.0 feet (5.5 feet average passenger car plus 1.5 feet) was not deemed psychologically acceptable, and a minimum "basic" clearance of 9.0 feet was postulated. Current standards call for a minimum vertical clearance of 12.5 feet on facilities where traffic is restricted to passenger vehicles. As there are few interchanges on highway-to-highway grade separations on other than freeways and expressways, the analysis was limited to Interstate and other freeways and expressways.

VEHICLE LENGTH

The report concluded that cost variations associated with differences in vehicle length would be of little consequence and did not postulate a basic vehicle length.

KANSAS DESIGN PRACTICES

The Leisch study identified the principal vehicle characteristics which most affect roadway design as being vehicle performance, vehicle width, and vehicle height. These characteristics will be examined to ascertain any relationship with Kansas design practices.

PROFILE GRADE

Vehicle performance, as defined by the maximum relative speed achieved on an upgrade, varies with the steepness of the grade and the vehicle weight to horsepower ratio. The Leisch study (p. 48) stated that profile design (maximum grade, critical length of grade, climbing lanes, emergency escape ramps, etc.) are not design considerations in flat terrain. The FHWA publication, An Investigation of Truck Size and Weight Limits, Vol. 7 (p. A-10), listed the approximate percentage distribution of terrain types along corridors served by the principal highway system. Kansas' Interstate, Primary, and Secondary corridors were each listed as lying in 90% flat terrain with the remaining 10% in rolling terrain. The 90% flat terrain in Kansas would not require any special attention for profile grades to satisfy needs of all vehicles. The remaining 10% rolling terrain conceivably might require some profile grade adjustment and/or climbing lanes. Climbing lanes in Kansas are signed with a "Slower Vehicles Keep Right" sign which clearly indicates that the climbing lanes are intended for both cars and trucks. In the opinion of KDOT's Bureau of Design, climbing lanes are an insignificant portion of the overall construction program. The Bureau of Design found only two instances during the past five years when climbing lanes had been provided. This indicates that avoidance of speed reduction of vehicles was accomplished through adjustments of profile grade. This adjustment might require additional excavation, embankment, and right-of-way width. The problem then becomes the identification of vehicle classes requiring flatter profile grades. Generally, vehicles with high weight to horsepower ratios are trucks. However, low horsepower subcompact automobiles also have high weights to horsepower ratios and also experience speed reduction on steeper grades. Both heavy trucks and subcompact automobiles benefit from flatter profile grades as well as other vehicles in the same traffic stream which are not delayed. Even though profile grade may require special attention during the design process in rolling terrain, any additional costs appear to be shared by various vehicle classes. Therefore from a cost allocation perspective in Kansas, profile grade is not a problem requiring a special allocation technique.

LANE AND SHOULDER WIDTHS

Lane width is a function of vehicle width along with some margin of safety required by drivers on either side of the vehicle. Shoulder width is also directly related to vehicle width in that one of the most important functions of highway shoulders is to provide space for stopping or moving off of the traveled way in emergency situations.

The Leisch study developed relationships between vehicle width and lane and shoulder widths for different types of vehicles and various classes of highways. The analysis was performed using cars (6-feet wide) and trucks (8-feet wide) with the relationship between vehicle width and lane and shoulder widths extrapolated to cover a broad range of vehicle widths. The Leisch study (Figure 2 - p. 8) advised that a 10.5 foot lane is sufficient for automobiles (6-feet wide) with a 12.5 foot lane required for trucks (8-feet wide). Shoulder widths recommended for a minor arterial are 5 feet for automobiles and 6 feet for trucks. The recommended shoulder widths for a primary arterial are 8 feet and 10 feet for automobiles and trucks respectively.

The Kansas Highway Cost Allocation Study used the concept of a basic service road and a full service road. The basic service road is one which could adequately accommodate the smallest reasonable number of vehicles of the smallest reasonable size or weight. The full service road would have the necessary additional width and strength to provide service to an additional number of vehicles of which many may be wider and heavier. The basic service road essentially would be a collector road with a very low traffic volume. The full service road essentially would be a principal arterial with a substantial traffic volume.

Table 1, COMPARATIVE DIMENSIONS OF BASIC AND FULL SERVICE ROADWAYS, lists lane, shoulder, and roadway widths recommended by Leisch, AASHTO, and KDOT. In addition the widths to be used in the Cost Allocation Study are shown. The width assignments are generally consistent with the most prevalent design practices.

TABLE 1

COMPARATIVE DIMENSIONS OF
BASIC AND FULL SERVICE ROADWAYS

ITEM	BASIC SERVICE ROADWAY (MINOR COLLECTOR)	FULL SERVICE ROADWAY (PRINCIPAL ARTERIAL)
Traffic Volume	Less then 400 AADT*	Greater than 3,000 AADT*
Traffic Types	Primarily automobiles, pickups and vans	Mixed-includes trucks
LANE WIDTHS		
Leisch Study	10.5 feet	12.5 feet
AASHTO Desirable	11.0 feet	12.0 feet
AASHTO Minimum	11.0 feet	12.0 feet
Kansas Design	11.0 feet	12.0 feet
COST ALLOCATION WIDTH	11.0 feet	12.0 feet
SHOULDER WIDTHS		
Leisch Study	5.0 feet	10.0 feet
AASHTO Desirable	6.0 feet	10.0 feet
AASHTO Minimum	4.0 feet	8.0 feet
Kansas Design	2.0 feet	8.0 feet
COST ALLOCATION WIDTH	4.0 feet	8.0 feet
ROADWAY WIDTH		
Leisch Study	31.0 feet	45.0 feet
AASHTO Desirable	34.0 feet	44.0 feet
AASHTO Minimum	30.0 feet	40.0 feet
Kansas Design	26.0 feet	40.0 feet
COST ALLOCATION WIDTH	30.0 feet	40.0 feet

*AADT=Annual Average Daily Traffic

BASIC VEHICLE

The Leisch Study, as discussed earlier, used automobiles (6 feet wide) and trucks (8 feet wide) as being basic width and additional width vehicles respectively. The 1982 Federal Cost Allocation Study divided the vehicle population into width increments. The Federal Study used incremental lower boundaries of vehicle widths (in feet) of 7.8, 7.33, 7.1, 6.8, 5.8, 5.0, 2.5, 2.2 and 0, respectively. Most vehicle classes (28 of the 38 classes including buses and all but the lightest trucks were wider then 7.8 feet). For this reason, vehicle classes, from a width perspective, can be divided into two classes, basic width and additional width classes. Table 2, VEHICLE CLASSES BY VEHICLE WIDTH, lists the two classes, basic width and additional width vehicles.

TABLE 2

VEHICLE CLASSES BY VEHICLE WIDTHS

BASIC WIDTH VEHICLE CLASSES	ADDITIONAL WIDTH VEHICLE CLASSES
Automobiles	Single Unit Trucks-6 tires
Motorcycles	Single Unit Trucks-3 axles
Single Unit Trucks-4 tires	Combination Trucks-3 axles
	Combination Trucks-4 axles
	Combination Trucks-3S2
	Combination Trucks-5 axles
	Combination Trucks-6+ axles

Vehicle weight is also a factor in the selection of a basic vehicle. The weight enters into bridge design and the allocation of bridge costs. The selection of the maximum weight for a basic vehicle must be compatible with registration data and bridge design increments. Motorized bicycle, motorcycles, and electric vehicles have relatively light vehicle weights and are not registered by weight. Automobiles are registered in four weight classes. Light trucks are registered in a group of 12,000 pounds or less gross vehicle weight. Many of the 12,000 pounds or less gross vehicle weight trucks are essentially passenger vehicles used for light hauling and would weigh about the same as a heavy automobile. The 12,000 pound or less vehicle can be accommodated by an H5 bridge design`increment. For the purposes of this study, trucks with a registered gross vehicle weight of 12,000 pounds or less will be considered to be a basic vehicle along with automobiles, motorcycles, motorized bicycles and electric vehicles.

SUMMARY

The basic service road used in this study will have 11 foot lanes and 4 foot shoulders. The full service road will have 12 foot lanes and 8 foot shoulders. The basic vehicle, for the purposes of this study, will be identified by width and by weight. For costs allocated by width, basic vehicles will consist of automobiles, motorcycles, and 4-tired single unit trucks. For costs allocated by weight, basic vehicles will include all vehicles registered for a gross vehicle weight of 12,000 pounds or less.

REVIEW PROCESS
BASIC ROAD AND VEHICLE ISSUES

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL REVIEW ADJUSTMENTS
Vertical Alignment The task force used the term "gradability" to describe the climbing ability of vehicles.	The task force concurs with commenters who suggested using "climbing ability."	

end of appendix A blank on purpose

APPENDIX B
BRIDGE ISSUES

BACKGROUND AND DEFINITIONS

For purposes of the Kansas Highway Cost Allocation Study, bridges are defined as structures having combined span lengths of greater than 20 feet. Measurement of structure length is explained on page 19 (Item 49) of the "Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges", January 1979.

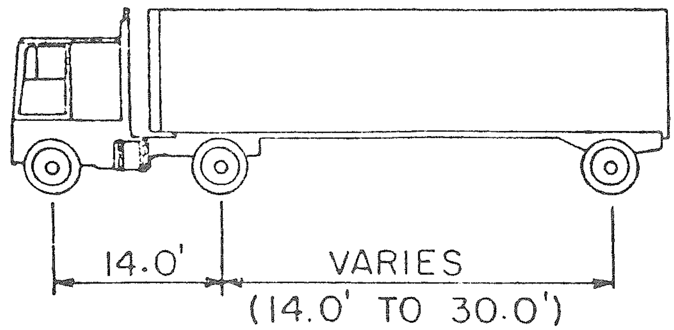
A new bridge is defined as a new structure, constructed on new alignment, built solely to increase capacity or improve service of the highway system. It does not replace an existing bridge. New structures are designed and proportioned for the following loads and forces: dead load, live load, impact or dynamic effect of the live load, wind loads, and other forces, where they exist, such as longitudinal forces, centrifugal forces, thermal forces, earth pressure, etc. Liveload design of bridges is accomplished by applying "standard" trucks (H or HS loadings) or lane loads which are equivalent to truck trains. Axle spacings and loadings are varied such that maximum design load anticipated for the structure can be achieved and the bridge designed to carry this load. The type of loading, whether lane loading or truck loading, to be used, and whether the spans be a simple or continuous design, is always based upon the loading which produces the maximum stress. See Figure 1.

A bridge replacement is a structure built specifically at, or in close proximity to, the same site to replace an inadequate existing bridge. Bridges are built to replace existing structures for a variety of reasons. They may be structurally unable to carry some of the heavy vehicles that might use them; they may be too narrow for modern traffic, in other words, structurally deficient or functionally obsolescent.

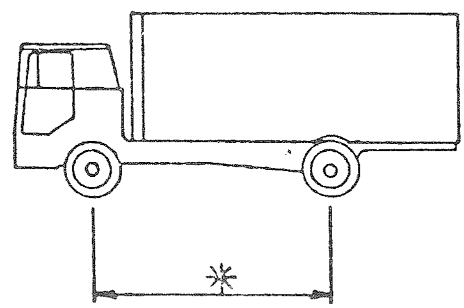
Bridge repairs consist of any contract work performed on an existing structure with the intention of extending service life or protecting the original investment. Bridge rehabilitations are performed for the purpose(s) of correcting structural deficiencies, slowing physical deterioration or alleviating functional obsolescence.

The basic premise of the Kansas Highway Cost Allocation Study is the occasioned cost concept; i.e., vehicle classes which cause (occasion) highway improvement expenditures should be the vehicle classes which are responsible for those costs. Consequently, much attention and discussion have been devoted by the Highway Cost Allocation Task Force to the selection cost allocation methodologies which would most accurately reflect the parameters that best measure disproportionate responsibility for costs among various vehicle classes.

BRIDGE DESIGN INCREMENTS



HS 20	8,000LBS.	32,000LBS.	32,000LBS.
HS 15	6,000LBS.	24,000LBS.	24,000LBS.



H 20	* = 14.0'	8,000LBS.	32,000LBS.
H 15	* = 14.0'	6,000LBS.	24,000LBS.
H 10	* = 14.0'	4,000LBS.	16,000 LBS.
H 5	* = 12.0'	3,000LBS.	7,000 LBS.

FIGURE 1

NEW BRIDGE

Possible wearing out (or fatigue) of the bridge structural members is implicitly considered to some extent in the design process but only the heaviest vehicles have measurable effect on the fatigue life of a bridge. Because of this nearly total dependence of designed bridge strength on gross weights of vehicles, heaviest vehicles would have to be removed first in a hypothetical design process for cost assignment. This process follows a typical incremental cost allocation approach. The incremental method is generally considered to be a sound approach to the allocation of various highway bridge costs among vehicle groups. The cost of increased structural strength of bridges required for successively heavier gross vehicle weights is allocated to the vehicles requiring the increased strength.

Under the incremental method, a bridge is designed for the full design loading anticipated. The first group of heaviest vehicles is removed from the loading and a hypothetical bridge designed. The difference in cost between this hypothetical bridge and the full structure is assigned to those heavy vehicles which were removed on the basis of vehicle miles traveled (VMT). A second group of heavy vehicles is then removed (as well as the first group); a second hypothetical bridge is designed; the difference in cost between the first and second hypothetical bridges is assigned to all vehicles (on the basis of VMT) removed up to that point. This process is repeated until removing vehicles makes no significant difference in the cost of the needed facility. Costs below this point (basic bridge) are assigned to all vehicles on the basis of axle-miles traveled (AMT).

Alternative means of allocating new structure costs have been considered. Methods such as vehicle-miles of travel, ton-miles of travel, or axle-miles of travel do not provide an equitable means of considering the effects of gross weight vehicles on structure design. The gross ton-mile method of allocating costs in proportion to the gross operating weight of the vehicle multiplied by the annual miles traveled is relatively simple to implement but has been criticized for not accurately reflecting the distribution of highway costs. The reason is that trucks do not operate at their maximum gross weight (tonnage) at all times. Ultimately the incremental (weight-removed) method was selected as being the most feasible and most compelling.

It is recognized that the basic problem of economy of scale, associated with the non-linear relationship between load added and cost of the bridge, is present in structures as well as in pavements but the incremental method has been selected as being the best currently available.

It is necessary to assign costs of the basic bridge on a non-weight related basis, while taking into account traffic volumes and vehicle size classes. While a cost allocator based on passenger car equivalency-vehicle miles traveled (PCE-VMT) accounts for the frequency of use of the structure, it implies congestion or a need to apportion capacity but does not account for vehicle width or size.

BRIDGE REPLACEMENT

Because the reason(s) for replacement of a bridge can be ascribed, at least in part, to reasons other than a need for increased capacity or improved service, a cost allocation methodology which considers the reason(s) for replacement is necessary. In other words, to the extent that the reason for replacement of bridges is disproportionate among vehicles of different weights and sizes, the allocated cost responsibility for the basic bridge should be disproportionate.

However, care must be taken, as in the case of bridges replaced because of inadequate load-carrying ability; the argument can be made that those vehicles weighing more than the posted load should bear the entire cost of the basic replacement structure. The problem with this argument is that it overlooks two essential considerations: (1) rarely is restricted load-carrying capacity the sole reason for replacing a bridge, and (2) even when it is the sole reason, clear benefits are also bestowed on vehicles weighing less than the posted weight, if only through the extended service life available through the replacement bridge. Thus, for the Kansas study, all classes of vehicles share in responsibility for the basic portion of replacement bridges although the shares may be unequal and different than for new bridges.

The structural sufficiency rating formula, a method of evaluating factors which are indicative of bridge sufficiency to remain in service, can be used to determine the relative contribution of each of numerous factors to the need for replacement of a given bridge. To the extent that the need for replacement of an individual bridge is due to traffic-related factors, costs can be assigned to the corresponding vehicles based on the sufficiency rating components. This study will utilize the load-carrying deficiency of a bridge as evidenced by official load posting signs. The costs required to restore load carrying capacity will be allocated by vehicle miles traveled (VMT) to those vehicles heavier than the weight carrying capacity of the replaced bridge. The remainder of the cost will be allocated incrementally in the same manner as new bridges.

BRIDGE REPAIR AND REHABILITATION

The deterioration of a bridge resulting in the need for repair or rehabilitation is sensitive to traffic volume and weight (impact) and to environment. Effects of traffic volume and weight can be measured by the frequency of impacts of vehicle axles (axle-miles traveled - AMT). Vehicle-miles traveled does not account for the effects of deterioration of the bridge. Passenger car equivalency accounts only for space occupied, which is not a factor in bridge deterioration. Ton-mile methods of cost allocation, while recognizing the effect of weight on bridge deterioration, do not accurately reflect the actual loaded weight (not gross vehicle weight) of heavier vehicles. Equivalent single axle load methodologies do not provide for a measure of gross vehicle weight, which is a greater factor in bridge wear than axle configurations and loadings.

While admittedly not an ideal allocator, axle-miles traveled accounts to some extent for traffic volume, traffic weight or impact, and environmental parameters, considering that deterioration caused by climatic factors is exacerbated by impact loadings of traffic.

DEVELOPMENT OF SELECTED STRUCTURE COST ALLOCATOR

NEW BRIDGE

In cooperation with the Bridge Section of KDOT's Bureau of Design, Kansas bridge types were sorted by Federal bridge types used by Benito A. Sinclair & Associates, Inc. in their report to the Federal Highway Administration entitled "Incremental Analysis of Structural Construction Costs" (pp. 3-5). This sort produced a percentage of Federal bridge types which were built in Kansas from 1980 through April 7, 1982 and is shown in Table 1, PERCENTAGE OF FEDERAL BRIDGE TYPES BUILT IN KANSAS FROM 1980 THROUGH APRIL 7, 1982.

TABLE 1

PERCENTAGE OF FEDERAL BRIDGE TYPES BUILT IN KANSAS FROM 1980 THROUGH APRIL 7, 1982

FEDERAL BRIDGE TYPE	KANSAS BRIDGE TYPE	PERCENT
1. Reinforced concrete slab (simply supported)	Reinforced Concrete Box Rigid Frame Box Steel Rigid Frame Corrugated Metal Pipe	12.79%
2. Reinforced concrete slab (continuous)	Reinforced Concrete Slab Continuous Reinforced Concrete Slab Haunched	30.23%
4. Reinforced concrete girder (simply supported)	Reinforced Concrete Deck Girder Haunched Reinforced Concrete Box Girder Continuous	6.97%
6. Prestressed continuous (precast girder)	Beam Continuous	23.26%
9. Continuous steel girder (medium)	Steel Beam Continuous	3.49%
9A. Continuous steel girder (long)	Steel Welded Plate Girder Continuous Steel Welded Plate Girder Haunched	23.26%
	Total	100.00%

A regression analysis was performed on 164 bridges let in Kansas during calendar years 1978 through 1982. The dependent variable was cost per square foot of bridge deck. The independent variable was the width of bridge deck. The regression analysis developed the following cost-width relationship:

$C = \$30.14 + 0.167W$

where

C = cost per square foot of bridge deck

w = bridge width in feet

TABLE 2 illustrates bridge widths from several references from which 28 feet was determined to be the Kansas basic service bridge, and 40 feet the Kansas full service bridge. A basic service bridge is one which has sufficient width and strength to satisfy a minimal number of basic vehicles. A full service bridge has additional width and strength to provide service to heavier vehicles and additional traffic. Using the regression formula, the cost for one lineal foot of basic and full service bridges is $974.85 and $1,472.80 respectively. This comparison shows that a 30 percent reduction in bridge width (40 feet to 28 feet) yields a 33.81 percent reduction in bridge costs.

TABLE 2

TYPICAL DIMENSIONS OF BASIC AND FULL SERVICE BRIDGES

REFERENCE	BASIC SERVICE BRIDGE (MINOR COLLECTOR)		FULL SERVICE BRIDGE (PRINCIPAL ARTERIAL)	
	TRAFFIC VOLUME	BRIDGE WIDTH	TRAFFIC VOLUME	BRIDGE WIDTH
AASHTO				
Design	<400	28'	3,000	44'
Remain-in-place	<400	28'	3,000	40'
PROJECT SELECTION SCOPING PARAMETERS				
Kansas Design	<400	28'	3,000	40'
Remain-in-place	<400	22'	3,000	28'
KANSAS PROPOSED MINIMUM GEOMETRIC DESIGN CRITERIA				
Reconstruction	<400	28'	3,000	36'
Remain-in-place	<400	22'	3,000	26'
DIMENSIONS USED IN KANSAS HIGHWAY COST ALLOCATION STUDY	<400	28'	>3,000	40'

Allocator precentages were then developed using the approach illustrated in Table 3. This table utilizes the percentages of variations of bridge cost with live loadings as shown in Tables 6.1, 6.2, 6.4, 6.6, 6.11, and 6.12 of Sinclair's "Incremental Analysis of Structural Construction Cost." The costs of new bridges will then be allocated to vehicles requiring specific bridge design increments in accordance with the procedure shown in Figure 2.

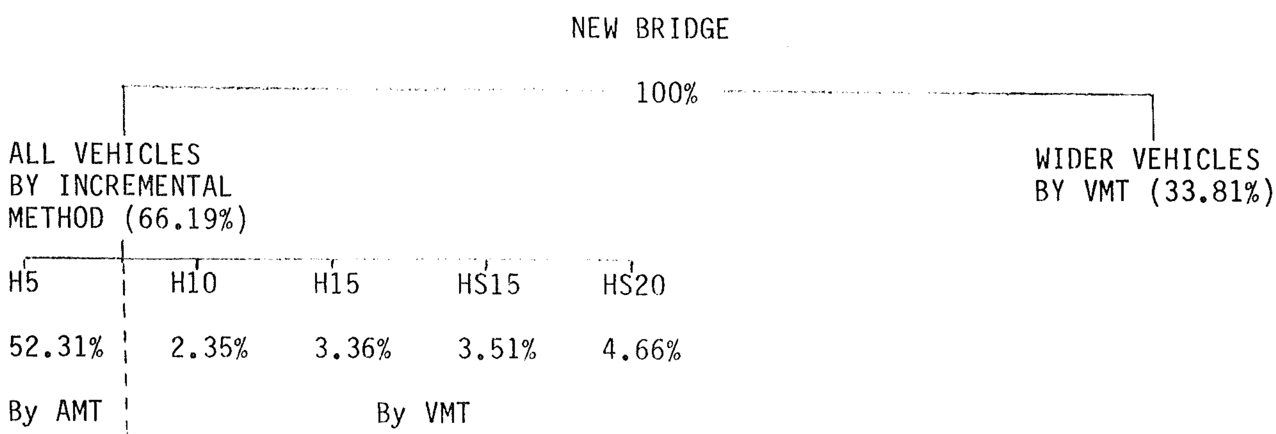
TABLE 3

ANALYSIS OF INCREMENTAL COSTS OF FEDERAL BRIDGE TYPES BUILT IN KANSAS

FEDERAL BRIDGE TYPE	PERCENT BUILT IN KANSAS	PERCENT COST REDUCTION DUE TO WIDTH REDUCTION	PERCENT VARIATION OF BRIDGE COST WITH LIVE LOADING				
			HS5	HS10	H15	HS15	HS20
1.	12.79	33.81	82.6	86.6	90.7	94.7	100.0
2.	30.23	33.81	87.0	88.3	91.8	95.1	100.0
4.	6.97	33.81	86.4	89.7	90.8	96.6	100.0
6.	23.26	33.81	85.8	87.1	90.4	95.3	100.0
9.	3.49	33.81	81.7	84.5	89.5	91.8	100.0
9A.	23.26	33.81	87.8	91.2	94.6	96.2	100.0
Weighted Increments for Kansas built bridges	100.00	33.81	86.12	88.47	91.83	95.34	100.0
Percent increase per increment		33.81	52.31	2.35	3.36	3.51	4.66

FIGURE 2

NEW BRIDGE ALLOCATION PROCEDURE



BRIDGE REPLACEMENT

Bridges with a posted weight restriction being replaced will have the costs required to restore load carrying capacity allocated by VMT to those vehicles heavier than the posted weight limit with the remainder allocated incrementally in the same manner as new bridges. The cost required to restore load carrying capacity for an H5 posted bridge would be the sum of the incremental increases shown in Table 3 for H10, H15, HS15, and HS20 design increments. The cost required to restore load carrying capacity for an H10 posted bridge would be the sum of the incremental increases shown in Table 3 for H15, HS15, and HS20 design increments. The cost required to restore load carrying capacity for an H15 posted bridge would be the sum of the incremental increases shown in Table 3 for HS15 and HS20 design increments. The cost required to restore load carrying capacity for an HS15 posted bridge would be the incremental increase shown in Table 3 for the HS20 design increment. Table 4, "Bridge Replacement Cost Increments Required for Restoring Load Carrying Capacity" lists the total percentage of costs allocated to heavier vehicles for restoration of load carrying capacity for posted bridge design increments.

TABLE 4

BRIDGE REPLACEMENT COST INCREMENTS
REQUIRED FOR RESTORING LOAD CARRYING CAPACITY

POSTED DESIGN INCREMENT	PERCENT INCREASE IN BRIDGE COSTS BY DESIGN INCREMENT				TOTAL PERCENT TO HEAVIER VEHICLES
	H10	H15	HS15	HS20	
H5	2.35	3.36	3.51	4.66	13.88
H10	----	3.36	3.51	4.66	11.53
H15	----	----	3.51	4.66	8.17
HS15	----	----	----	4.66	4.66

Figures 2, 3, 4, 5, and 6 illustrate the cost allocation procedure used for replacement of existing posted bridges of the several design increments.

FIGURE 3

REPLACEMENT BRIDGE ALLOCATION PROCEDURE FOR AN H5 REPLACEMENT BRIDGE

100%

- VEHICLES GREATER THAN H5 — 13.88%
  - H10=2.35%
  - H15=3.36%
  - HS15=3.51%
  - HS20=4.66%
- REMAINING VEHICLES BY INCREMENTAL — 52.31%
  - Multiplier= $\frac{52.31\%}{66.19\%} = 0.7903$
  - H5=(0.7903)(52.31%) 41.34%
  - H10=(0.7903)(2.35%) 1.86%
  - H15=(0.7903)(3.36%) 2.66%
  - HS15=(0.7903)(3.51%) 2.77%
  - HS20=(0.7903)(4.66%) 3.68%
- WIDER VEHICLES BY VMT — 33.81%

FIGURE 4

REPLACEMENT BRIDGE ALLOCATION PROCEDURE FOR AN H10 REPLACEMENT BRIDGE

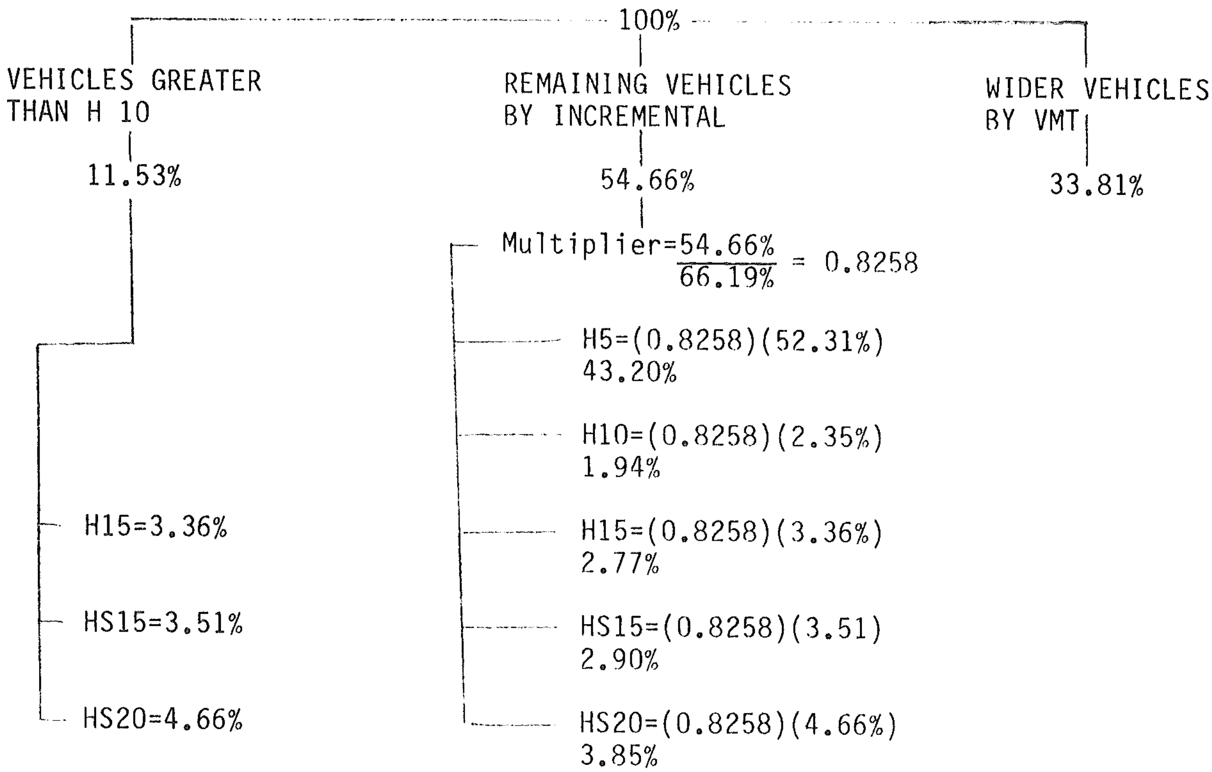


FIGURE 5

REPLACEMENT BRIDGE ALLOCATION PROCEDURE FOR AN H15 REPLACEMENT BRIDGE

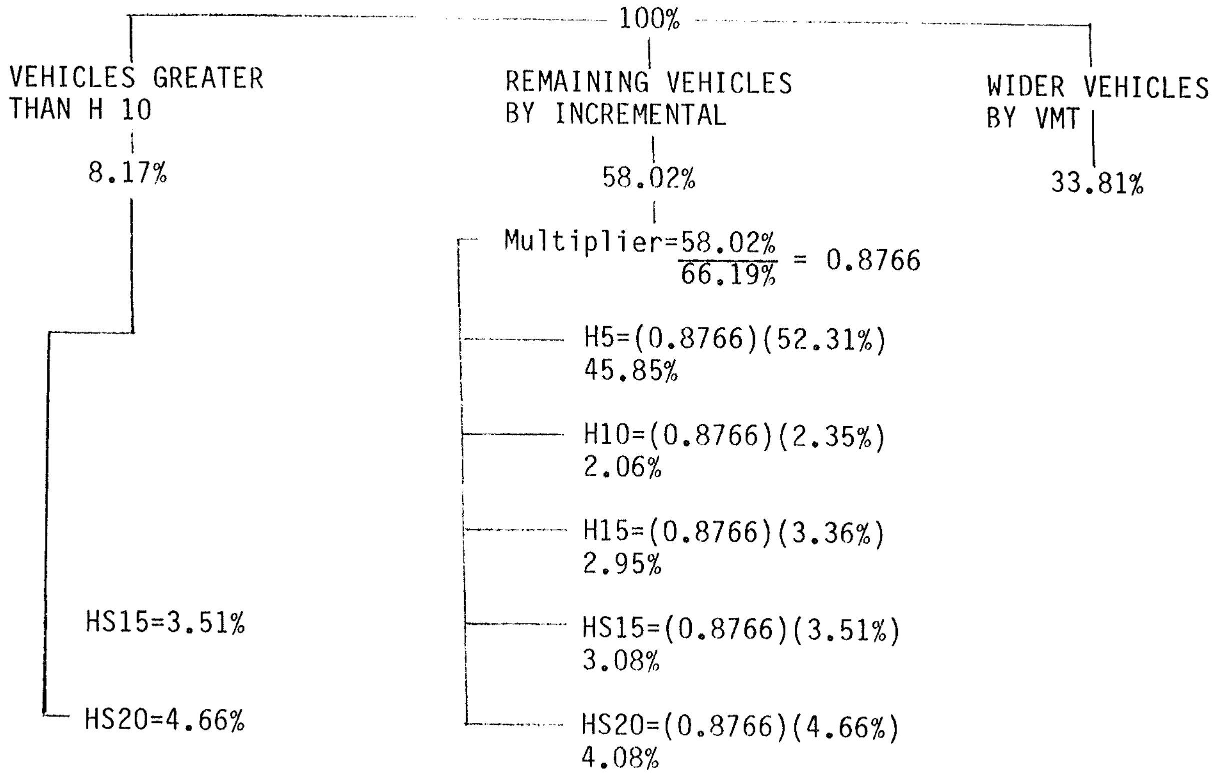


FIGURE 6

REPLACEMENT BRIDGE ALLOCATION PROCEDURE FOR AN HS 15 BRIDGE

100%

VEHICLES GREATER THAN HS 15

4.66%

HS20=4.66%

REMAINING VEHICLES BY INCREMENTAL

61.53%

$$\text{Multiplier}=\frac{61.53\%}{66.19\%} = 0.9296$$

H5=(0.9296)(52.31%)
48.63%

H10=(0.9296)(2.35%)
2.19%

H15=(0.9296)(3.36%)
3.12%

HS15=(0.9296)(3.51%)
3.26%

HS20=(0.9296)(4.66%)
4.33%

WIDER VEHICLES BY VMT

33.81%

A comparison of allocated costs of replacement bridges with the allocated costs of new bridges is shown in Tables 5, 6, 7, and 8. Each table has a footnote remark describing the cost shift from basic vehicles to heavier vehicles.

TABLE 5

COMPARISON OF NEW BRIDGE INCREMENTAL TECHNIQUE AND REPLACEMENT BRIDGE TECHNIQUE FOR AN H5 BRIDGE

INCREMENT	REPLACEMENT BRIDGE				NEW BRIDGE
	WEIGHT DEFICIENCY PORTION	ADDITIONAL INCREMENTAL ALLOCATION	WIDTH	TOTAL	
H5 Basic Vehicle	-	49.34%	-	41.34%	52.31%
H10	2.35%	1.86%	-	4.21%	2.35%
H15	3.36%	2.66%	-	6.02%	3.36%
HS15	3.51%	2.77%	-	6.28%	3.51%
HS20	4.66%	3.68%	-	8.34%	4.66%
Width	-	-	33.81%	33.81%	33.81%
Totals	13.88%	52.31%	33.81%	100.00%	100.00%

The net effect of using the replacement bridge technique for an H5 bridge is to shift 10.97% (52.31% - 41.34%) of costs from basic vehicles to heavier vehicles.

TABLE 6

COMPARISON OF NEW BRIDGE INCREMENTAL TECHNIQUE AND REPLACEMENT TECHNIQUE FOR AN H10 BRIDGE

INCREMENT	REPLACEMENT BRIDGE				NEW BRIDGE
	WEIGHT DEFICIENCY PORTION	ADDITIONAL INCREMENTAL ALLOCATION	WIDTH	TOTAL	
H5	-	43.20%	-	43.20%	52.31%
H10	-	1.94%	-	1.94%	2.35%
H15	3.36%	2.77%	-	6.13%	3.36%
HS15	3.51%	2.90%	-	6.41%	3.51%
HS20	4.66%	3.85%	-	8.51%	4.66%
Width	-	-	33.81%	33.81%	33.81%
Totals	11.53%	54.66%	33.81%	100.00%	100.00%

The net effect of using the replacement bridge technique for an H10 bridge is to shift 9.11% (52.31% - 43.20%) of costs from basic vehicles to heavier vehicles.

TABLE 7

COMPARISON OF NEW BRIDGE INCREMENTAL TECHNIQUE AND REPLACEMENT TECHNIQUE FOR AN H15 BRIDGE

INCREMENT	REPLACEMENT BRIDGE				NEW BRIDGE
	WEIGHT DEFICIENCY PORTION	ADDITIONAL INCREMENTAL ALLOCATION	WIDTH	TOTAL	
H5	-	45.85%	-	45.85%	52.31%
H10	-	2.06%	-	2.06%	2.35%
H15	-	2.95%	-	2.95%	3.36%
HS15	3.51%	3.08%	-	6.59%	3.51%
HS20	4.66%	4.08%	-	8.74%	4.66%
Width	-	-	33.81%	33.81%	33.81%
Totals	8.17%	58.02%	33.81%	100.00%	100.00%

The net effect of using the replacement bridge technique for an H15 bridge is to shift 6.46% (52.31% - 45.85%) of costs from basic vehicles to heavier vehicles.

TABLE 8

COMPARISON OF NEW BRIDGE INCREMENTAL TECHNIQUE AND REPLACEMENT TECHNIQUE FOR AN HS15 BRIDGE

INCREMENT	REPLACEMENT BRIDGE				NEW BRIDGE
	WEIGHT DEFICIENCY PORTION	ADDITIONAL INCREMENTAL ALLOCATION	WIDTH	TOTAL	
H5	-	48.63%	-	48.63%	52.31%
H10	-	2.19%	-	2.19%	2.35%
H15	-	3.12%	-	3.12%	3.36%
HS15	-	3.26%	-	3.26%	3.51%
HS20	4.66%	4.33%	-	8.99%	4.66%
Width	-	-	33.81%	33.81%	33.81%
Totals	4.66%	61.53%	33.81%	100.00%	100.00%

The net effect of using the replacement bridge technique for an HS15 bridge is to shift 3.68% (52.31% - 48.63%) of costs from basic vehicles to heavier vehicles.

SUMMARY

The Kansas Highway Cost Allocation Study addresses three levels of bridge costs. These costs are for new bridges, for replacement bridges, and for the repair and rehabilitation of bridges. The costs of new bridges will be allocated by the incremental methodology used in the 1982 federal study. The costs of replacement bridges will also be allocated by the incremental methodology except that costs required to restore weight capacity of posted bridges will be allocated to heavier vehicles requiring additional weight capacity. For both new and replacement bridges, the costs of the basic (H5) bridge will be allocated to all vehicles by axle miles traveled (AMT). Costs for additional width and weight capacity for both new and replacement bridges will be allocated by vehicle miles traveled (VMT). Costs for repair and rehabilitation of bridges will be allocated by axle miles traveled (AMT).

REVIEW PROCESS
BRIDGE ISSUES

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL ADJUSTMENTS
<u>Reason for Replacing a Bridge</u> The task force stated that bridges are replaced when they are worn out.	The task force concurred with a commenter who stated that bridges are replaced when they become structurally deficient or functionally obsolescent.	
<u>Bridge Dimensions</u> The task force stated that an existing full service bridge with a 28' width may remain in place in accordance with the Kansas Proposed Minimum Geometric Design Criteria.	The task force concurred with a commenter that an existing full service bridge with a 26' width may remain in place in accordance with the Kansas Proposed Minimum Geometric Design Criteria.	

end of appendix B   blank on purpose

APPENDIX C
DATA REQUIREMENTS AND SOURCES

This paper provides a discussion of the data requirements of the Kansas Highway Cost Allocation Study. Data requirements discussed will include both cost allocation and revenue attribution portions of the study. The discussion is conceptual only and will not contain data tables. The cost allocation and revenue attribution portions will require many of the same data items but may require different details. Both historical data and forecast values of the various data elements will generally be necessary for the study. Historical values may serve as a basis for forecasts. Forecasts will be needed for the proposed study period.

Data will be required in the general areas of KDOT expenditures, road types, traffic volumes, and revenues. Further discussion of specific requirements in each of these areas will follow in this paper.

STUDY PERIOD

The study period will be limited to the fiscal years 1985, 1986, 1987, and 1988. Fiscal year 1985 begins July 1, 1984, and is the budget year for which budget requests have been prepared for submission to the 1984 session of the Kansas Legislature. The FY 1985 budget request will be used as the forecast expenditure amounts for FY 1985. Forecasts for fiscal years 1986, 1987, and 1988, with the exception of the construction program, will need to be developed.

KDOT EXPENDITURES

KDOT expenditures, as used in the cost allocation study, will be limited to Kansas dollars only. Federal funds utilized in the construction, planning, design, and research programs have already been allocated at the federal level. However, care must be taken to assure exclusion of federal funds. KDOT expenditures will include the Kansas dollars portion of the KDOT budget. This will include construction, maintenance, engineering and design, freeway debt service, administration, and statutory disbursements.

CONSTRUCTION PROGRAM

A five year construction program has been published. The five years consist of fiscal years 1984, 1985, 1986, 1987, and 1988. The program for FY 1984 is the on-going program and will not be a part of the cost allocation study. Fiscal years 1985 and 1986 construction programs are considered stable. However, the remaining years are fixed only to the extent that the published program will be scheduled during the three year interval subject to revenue changes. This will necessitate aggregating data for the three year period.

Data for the construction program will be obtained from the published program and from the Project Authorization Forms (No. 883). Generally this will provide sufficient disaggregation so that construction expenditure categories can be quantified. The construction expenditure categories will include right-of-way, grading, drainage, pavements (new and rehabilitated), shoulders, bridges (new, replaced, repaired, and rehabilitated), and miscellaneous construction. Proposed pavement thicknesses will be supplemented with data from the Bureau of Materials and Research. Bridge posting values will be obtained from the Bureau of Design.

In order to eliminate discretionary assignment of projects to those totally funded with Kansas dollars or to those partially funded with federal dollars, a threefold classification will be used. The first classification would be the types of projects most likely to be totally funded with Kansas dollars. Another classification would be the types of projects most likely to be funded with federal dollars. The remaining classification would be discretionary types of projects which could be either totally funded with Kansas dollars or partially funded with federal dollars. Kansas funds for discretionary projects will be equitably distributed. This will insure that all classes of vehicles will equitably share in the costs of discretionary projects.

All of the construction administration costs will be considered to be project related and will be allocated in the same proportions as construction projects.

MAINTENANCE PROGRAM

Maintenance expenditures are a specific part of the KDOT budget. The proposed budget for FY 1985 will be used for allocating costs for 1985. The out years of 1986, 1987, and 1988 will be forecast utilizing actual expenditures in 1984, proposed expenditures for 1985, and the judgement of experienced personnel from the Bureau of Construction and Maintenance.

The maintenance program consists of overhead cost, common costs, and attributable costs. Overhead costs are those costs either not affected or only marginally affected by changes in vehicle travel. Common costs are those costs that are common to all vehicles and either not affected or only marginally affected by vehicle size or weight. Attributable costs are those costs that are sensitive to vehicle size or weight. The on-going FY 1984 budget and the proposed FY 1985 budget will be utilized in determining the relative proportions of overhead, common and attributable costs. Maintenance cost accounting is sufficiently detailed so that the three cost levels can be identified and is shown in Table 1, Maintenance Work Categories.

TABLE 1

MAINTENANCE WORK CATEGORIES

OVERHEAD COSTS	COMMON COSTS	ATTRIBUTABLE COSTS
Training	Drainage	Pavement
Meetings	Roadside & Landscape	Shoulders
Leave	Spraying	Bridges
Administration	Signs & Markers	Striping and Marking
Equipment	Snow and Ice	Traffic Control Service
Building	Lighting	Motor Carrier Stations
Land	Rest Areas	
Longitudinal Barriers	Fencing	
Emergency Operations	Litter Pickup	
Detours	Motorist Service	
	Park Roads	

ENGINEERING AND DESIGN

A substantial portion of engineering and design activities is directly related to construction projects. The engineering activities would include both preliminary (surveys, geotechnical, etc.) and construction engineering. The portion of these activities that are project related will be obtained from project authorization forms and allocated in the same manner as the construction projects. Remaining costs will be considered to be administration and will be allocated in the same manner as administration.

FREEWAY DEBT SERVICE

The dollar amounts of freeway debt service will be obtained from the proposed retirement schedule. The freeway debt service will be allocated to various classes of vehicles in accordance with a separate cost allocation study of only those freeway projects which will be constructed during the four year study period. Data requirements for freeway construction projects will be the same as for other construction projects.

ADMINISTRATION

Administrative functions include the Office of the Secretary of Transportation, data processing, legal, budget, planning, personnel, and the non-project related costs from the Division of Engineering and Design and the Division of Operations. The proposed budget for FY 1985 will be used for allocating costs for 1985. The years of 1986, 1987, and 1988 will be forecast utilizing actual expenditures in 1984, proposed expenditures for 1985, and the judgement of experienced personnel from the Bureau of Management and Budget.

STATUTORY DISBURSEMENTS

The amount of statutory disbursements will need to be divided into three parts. The first part would be the costs of the Motor Carrier Inspection Bureau. The second part would be the costs of Driver Licensing and Vehicle Registrations. The third part would be all other statutory disbursements from highway funds. The proposed budget for FY 1985 will be used for allocating costs for 1985. The out years of 1986, 1987, and 1988 will be forecast utilizing actual expenditures in 1984, proposed expenditures for 1985, and in consultation with experienced personnel from KDOT's Bureau of Management and Budget and from the Department of Revenue.

ROAD SYSTEM

The road system to be used in the study will be restricted to the rural state highway system and city connecting links. The approximately 10,000 mile system will be divided into Interstate and non-Interstate portions.

Construction projects for Interstate and non-Interstate are identified in the construction program. The relative traffic volumes will be obtained from the Bureau of Transportation Planning.

TRAFFIC VOLUMES AND TYPES

Traffic volume information used in the study will be obtained from the Bureau of Transportation Planning. The Bureau uses continuous traffic counters at 96 locations. In addition, over 3,000 short period (24 hour) machine counts are also conducted. Annual 24 hour vehicle classification studies provide information as to the relative proportions of different types of vehicles. Truck size and weight surveys are conducted at least every two years. Additional truck size and weight information is available from federal regional truck surveys.

Truck size and weight surveys provide information as to registered and observed gross vehicle weights, axle weights and spacing, vehicle configurations, type of commodity being hauled, and the type fuel used. The registered gross vehicle weight and type fuel is germane to revenues. The observed gross vehicle weights, axle weights and spacing, and vehicle configuration is germane to wear and stress imparted to the roadway system. Axle weights and spacing will be used to compute the 18,000 pound equivalent single axle loading values which are used in allocating pavement cost.

REVENUES

The Kansas Department of Transportation is financed primarily by a combination of federal-aid, vehicle registrations, driver licensing fees, motor fuel tax, and trip permits for out-of-state vehicles. A personal property tax on common carriers is passed through to cities and counties as well as a share of motor fuel revenues.

Motor fuel revenues are sensitive to the relative proportions of diesel, gasoline, gasohol, and LP gas used in vehicles because of varying tax rates per gallon. Revenues will decrease if gasohol is consumed in lieu of gasoline. Historical records are available for the relative market shares of the various fuels. However, the relative market shares are shifting which will seriously affect revenues. This study will utilize market predictions made by a consensus committee composed of members from the Kansas Department of Transportation, Kansas Department of Revenue, Legislative Research, and the Division of the Budget.

SUMMARY

The Kansas Cost Allocation Study will use the most current data available. Data requirements will include expenditures, traffic volumes, and revenues. Expenditures would include the construction program, the administration required to support the construction program as well as other KDOT functions, and disbursements to other state agencies and to counties and cities.

Traffic volumes and types will utilize studies and predictions made by the traffic section of the Bureau of Transportation Planning. Federal Highway Administration traffic studies will also be used where appropriate.

Revenue predictions for taxes from motor fuels will require particular attention because of changing market shares of gasoline and gasohol. These predictions will rely on estimates made by the consensus committee representing several state agencies. Other revenue predictions should not be as sensitive and will utilize historic trends and the judgement of experienced personnel.

REVIEW PROCESS
DATA REQUIREMENTS AND SOURCES

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL REVIEW ADJUSTMENTS
Maintenance Work Categories The task force classified Longitudinal Barriers, Emergency Operations, and Detours, as being attributable costs.	The task force concurred with commenters who considered these maintenance work categories as being overhead costs.	

end of appendix c   blank on purpose

APPENDIX D
FREEWAY DEBT SERVICE ISSUE

The 1972 Kansas State Legislature granted authority to the Kansas Department of Transportation to issue bonds aggregating $320,000,000 for the purpose of providing funds for the construction, reconstruction, and improvement of highway projects. Bonds were issued from 1972 through 1979. Net proceeds were deposited in the state Freeway Fund created in 1969 to receive motor fuel taxes to be used for express highways and freeways in specific corridors. The 1972 legislature authorized the State Freeway Fund to retire freeway bond principal and interest. Retirement began in 1973 and will continue through 2003. The retirement schedule is listed in Table 1.

EXPENDITURE IDENTIFICATION

Assets and fiscal income of the State Freeway Fund during the four year study period include money obtained from bonds, interest earned on unspent bond money, and dedicated motor fuel taxes. Fiscal distribution from the State Freeway Fund during the four year study period will include construction projects and freeway debt service. The construction projects will utilize funds obtained from bonds, interest earned on unspent bond money, and dedicated motor fuel taxes. Either the costs of construction projects financed by bonds, or the debt service to retire bonds, may be treated as an expenditure, but not both. To include both would be to expend the same funds twice. If construction projects are used as the expenditure, bond principal would be accounted for, but the interest portion of the debt service would have to be treated as a separate item. Utilizing debt service (principal and interest) avoids the need for special treatment of bond interest. Budget and accounting systems consider debt service as the expenditure. For consistency with budget and accounting systems, and to eliminate the need for special treatment of interest on the bonds, this study will consider debt service to be the expenditure.

COST ALLOCATION ALTERNATIVES

If debt service is the expenditure, an appropriate cost allocation methodology will need to be selected. The amount of debt service expended annually will not be affected by changes in amount of travel or by changes in vehicle classes. However, the bonds were issued for the purposes of constructing a system of expressways and freeways required to provide services for considerable amounts of mixed traffic. The expressed purpose of the bonds implies need for a full service road suitable for the travel needs of all vehicles. Since the travel needs of all vehicles are satisfied by the projects constructed with bond money, then all vehicles should share in the costs of bond retirement.

One potential method of allocating debt service payments for the period of this study and all future studies would be on the basis of all bond-financed projects constructed to date and of those proposed during the four year study period. This would be a special cost allocation study restricted to bond-financed projects during the period of 1972-1988. The relative percentages of cost responsibilities of various vehicle classes would be determined and applied to debt service requirements for the four year study period and for any future studies. It is probable that most of the bond money will be expended by the end of the four year study period; therefore, this approach would include most, if not all, of the bond projects and would have a very close fit between expenditures and vehicle cost responsibilities. This method would be difficult to implement because of the vast amounts of data needed, both as to projects and traffic. In addition, it would not be compatible with the remainder of the cost allocation study in that it would be a departure from the four year study period (FY 1985-1988).

A second possible method of allocating debt service payments is to treat it as a common cost which would be shared by all vehicles. This has the advantage of being much easier to accomplish than other approaches. However, it would remove the relationship of debt service to projects and relative cost responsibility of vehicle classes.

A third possible method would be to consider the bond-financed projects constructed during the four year study period to be representative of all bond-financed projects. The Freeway Debt Service would be allocated to the various vehicle classes on the basis of relative cost responsibility determined by the same methodology used for non-bond-financed projects. This method considers relative cost responsibility of various vehicle classes and would not require additional data but would require some additional data manipulation.

RECOMMENDATION

Freeway Debt Service will be allocated by a separate cost allocation study limited to bond financed projects during the four year study period (the second option). The freeway debt service cost allocation will be based upon the results. The freeway study and the parent study will be parallel studies using the same data collection and allocation techniques. This approach will insure a fair allocation of cost percentages to the various vehicle classes for this study and can also be used for future studies.

TABLE 1

PAYMENT SCHEDULE FOR FREEWAY BONDS

YEAR OF MATURITY	PRINCIPAL	INTEREST	TOTAL PRINCIPAL AND INTEREST
1972	-0-	-0-	
1973	$ 1,150,000.00	$ 4,352,801.00	$ 5,502,801.00
1974	41,780,000.00	5,721,851.00	7,501,851.00
1975	2,880,000.00	6,212,443.35	9,092,443.35
1976	12,750,000.00	6,891,272.50	19,641,272.50
1977	10,895,000.00	10,779,415.00	21,674,415.00
1978	11,530,000.00	12,885,433.33	24,415,433.33
1979	10,400,000.00	13,425,723.38	23,825,723.38
1980	10,635,000.00	14,469,730.00	25,104,730.00
1981	10,850,000.00	13,955,730.00	24,805,730.00
1982	11,165,000.00	13,414,580.00	24,579,580.00
1983	8,300,000.00	12,863,455.00	21,163,455.00
1984	8,805,000.00	12,360,430.00	21,165,430.00
1985	9,330,000.00	11,826,605.00	21,156,605.00
1986	9,890,000.00	11,260,780.00	21,150,780.00
1987	10,490,000.00	10,660,855.00	21,150,855.00
1988	11,090,000.00	10,043,155.00	21,133,155.00
1989	11,700,000.00	9,433,877.50	21,133,877.50
1990	12,340,000.00	8,816,917.50	21,156,917.50
1991	13,025,000.00	8,162,787.50	21,187,787.50
1992	13,755,000.00	7,469,760.00	21,224,760.00
1993	14,535,000.00	6,735,327.50	21,270,327.50
1994	15,365,000.00	5,955,725.00	21,320,725.00
1995	16,245,000.00	5,129,632.50	21,374,632.50
1996	12,695,000.00	4,255,225.00	16,950,225.00
1997	13,410,000.00	3,598,840.00	17,008,840.00
1998	10,855,000.00	2,905,250.00	13,760,250.00
1999	11,475,000.00	2,295,720.00	13,770,720.00
2000	12,130,000.00	1,649,095.00	13,779,095.00
2001	12,830,000.00	965,340.00	13,795,340.00
2002	5,100,000.00	370,250.00	5,470,250.00
2003	2,600,000.00	117,000.00	2,717,000.00
2004	-0-	-0-	-0-
Totals	$320,000,000.00	$238,985,007.06	$558,985,007.06

blank on purpose

REVIEW PROCESS
FREEWAY DEBT SERVICE ISSUES

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL REVIEW ADJUSTMENTS
	No Comments	

end of appendex d   blank on purpoe

APPENDIX E
PRORATION OF K-FUNDS

The Kansas Department of Transportation utilizes a mixture of Federal-Aid and Kansas Funds for financing highway construction. Generally, a specific project can be financed entirely with Kansas Funds (K-Funds) or with a mixture of Federal-Aid and K-Funds, or in a very few projects, with Federal-Aid Funds only. It is just as possible to state fund a bridge project and federal fund a pavement project in the same amount as it is to do the converse. The actual funding choice depends upon Federal-Aid fund balances and restrictions, upon project type emphasis, and upon the chronological order of project selection.

If the Kansas Highway Cost Allocation Study included both Federal-Aid and K-Funds, the allocation would be biased only by project type emphasis. However, the Kansas Highway Cost Allocation Study allocates only the K-Funds associated with the projects. Additional bias will occur if K-Fund assignment is unbalanced as is likely to occur.

The purpose of a cost allocation study is to determine the user cost responsibility of the various classes of vehicles. Construction costs are generally assessed against the various classes of vehicles on the basis of use related allocators such as vehicle miles traveled (VMT), ton miles traveled (TMT), and equivalent single axle loadings (ESAL). If all K-Funds were assigned to grading, the allocation would be on the basis of VMT and would be shared, in proportion to the amount of travel, by all classes of vehicles. If all K-Funds were assigned to pavements, the allocation would be on the basis of a combination of VMT and ESAL, which would shift additional cost responsibility to trucks. A comparable shifting of additional cost responsibility to trucks would occur if all K-Funds were assigned to bridges for which costs are allocated by a combination of travel (VMT), vehicle width, and vehicle registered weight.

To reduce bias to a minimum, the assigned K-Funds will be prorated. The proration will be on the basis of equal competition for K-Funds. The 1985-1988 Construction Program was sorted by work type. Total project costs and total projects assigned K-Funds were summed with the assigned K-Funds converted to percentage. This percentage was then multiplied by work type costs to obtain prorated K-Funds by work types. A similar procedure was performed for BC/SF funds involved in freeway construction. Some bias will remain, however, due to the project selection procedure being influenced by the amounts of Federal-Aid funds available in the various fund categories (Interstate, Primary, Bridge Replacement, etc.).

Table 1, "Comparison of Assigned and Pro-rated K-Funds and BC/SF Funds," lists the assigned and prorated K-Funds and BC/SF Funds. The proration procedure shifted K-Funds from rehabilitated pavements to new pavements and new bridges. The proration procedure shifted BC/SF Funds from new rigid pavements and new bridges to new flexible pavements and bridge repairs. The fund proration procedure reduces to a minimum any bias in project selection and fund assignment.

TABLE 1

COMPARISON OF ASSIGNED AND PRORATED K-FUNDS AND BC/SF FUNDS

WORK TYPE	ASSIGNED WORK TYPE K-FUNDS ($000) TOTAL	PRORATED WORK TYPE K-FUNDS ($000) TOTAL	ASSIGNED WORK TYPE BC/SF ($000) TOTAL	PRORATED WORK TYPE BC/SF ($000) TOTAL
Grading	$ 23,593	$ 28,877	$18,672	$18,776
Pavements				
**New Rigid	22,673	45,185	9,650	8,323
**New Flexible	12,472	14,459	9,655	10,301
**Rehab GT 1.50"	53,485	47,423	0	0
**Rehab LE 1.50"	86,759	33,455	112	74
Shoulders	6,159	5,061	2,490	2,455
Bridges				
**New	18,024	39,517	5,993	4,339
Bridges				
**Replacement				
****10 Tons	6,908	7,647	48	158
****15 Tons	2,993	3,569	0	0
****20+ Tons	2,881	1,628	0	0
***Not Posted	11,969	18,620	207	546
Bridge Repairs	10,413	12,343	816	2,688
Misc. Const	4,505	5,050	80	74
Totals	$262,834	$262,834	$47,732	$47,732

REVIEW PROCESS
PRORATION OF K-FUNDS ISSUES

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL REVIEW ADJUSTMENTS
<u>Bias in K-Fund Assignment</u> The task force stated that bias in K-Fund Assignment would be reduced through prorating on the basis of equal competition for K-Funds.	The task force concurred with a commenter who stated that bias will still remain due to the project selection procedure being influenced by the amounts of Federal-Aid funds available in the various fund categories.	

end of appendix E blank on purpose

APPENDIX F
LOCAL ROADS ISSUE

Highway Cost Allocation studies may be focused on the total highway system, or on some specific component of that system. The 1982 Federal Cost Allocation Study was limited to that portion of the national highway system with expenditures associated with the design, construction and rehabilitation of highway improvements financed from the Highway Trust Fund. The Federal Study, therefore, did not include costs and revenues unique to states and their political subdivisions. The Federal Study, however, acknowledged that the overall structure of road user charges could be equitable or efficient only if each level of government pursues consistent cost allocation and user charge policies.

BACKGROUND OF KANSAS HIGHWAY COST ALLOCATION STUDY

Kansas legislative interest in cost allocation began during the 1979 legislative session. The House Ways and Means Subcommittee proposed that the appropriation bill (SB-157) be amended to include a requirement that the Secretary of Transportation prepare a report on the maintenance needs of each district which would include "...estimates of additional wear caused by heavy traffic in each district." The amendment was not enacted into law, but the Secretary of Transportation was asked by the Conference Committee to prepare such a report.

The Secretary of Transportation advised the 1980 Special Committee on Transportation that the report requested by the 1979 Legislature to estimate wear caused by heavy traffic on the highways in each district had not been completed. Secretary Kemp further stated that these estimates could be better ascertained after a national highway cost allocation study had been completed. The national study is now complete and was submitted to the Congress on May 13, 1982.

GENERAL DEFINITION OF COST ALLOCATION

The December 1981 Report on Kansas Legislative Interim Studies to the 1982 Legislature noted that cost allocation is a term applied to the study of the distribution of costs for highway construction and maintenance between categories of highway users and non-users and among the various classes of highway users. The general goals of highway cost allocation studies are to:

1. Determine the share each class of payer should contribute.

2. Determine the difference between what each class pays and what it should pay.

3. Revise the tax structure to insure that each class pays approximately its allocated share.

REVENUES

The predominant revenue sources for the various Kansas highway systems include state user charges, federal funds, local property taxes, and bonding. Federal funds, with some off-system exceptions, are allocated to the state highway system, and to the federal aid secondary and federal aid urban portions of county and city highway systems respectively. The state highway system's principal sources of revenue are motor vehicle fuel tax, federal aid, vehicle and operators license and fees, and bonds for freeway construction.

Cities and counties finance their highway systems by property taxes and assessments, state aid (Special City and County Highway Fund and the County Equalization and Adjustment Fund), and federal aid. The relative financing of city and county highways is shifting from property taxes to user taxes (state aid). In 1964 the county property tax was 7.8 times larger than state aid as contrasted to 3.8 times in 1979. Similar figures for cities were 4.5 times and 2.8 times for 1964 and 1979 respectively.

GENERAL REVENUE LIMITS

The state highway system is improved, maintained, and administered primarily by user fees from vehicle and driver registrations and fuel taxes. These fees are set by statute. Historically, total vehicle travel has generally increased each year resulting in additional fuel consumption and a corresponding increase in user fees from fuel taxes. However, energy efficient vehicles developed as a response to the 1974 Arab oil embargo use less fuel, and in turn pay less fuel tax. Many predictions indicate that, even though an increase in travel is expected, the transition to fuel efficient vehicles may cause fuel consumption to reach a plateau and level off. A plateau in fuel consumption would also be a plateau for fuel taxes without an increase in the gallonage rate.

The maximum rate of levy for property tax dedicated to county roads and bridges is fixed by statute (KSA 79-1947) to a maximum of 10 mills in counties with a county unit system and 5 mills in counties without a county unit system. The statutes provide ways for counties to exceed the tax lid through no fund warrants and other means. The property tax lid has not been reached in 70 counties. Table 1, entitled "1981 County Road and Bridge Mill Levy," lists the counties, their mill levy, and their tax lid status. A listing and description of these statutes are included in Table 2 entitled "TAX LEVIES, NO-FUND WARRANTS, BONDS."

Cities do not have a statutory maximum property tax levy for streets. Cities are generally restricted to an overall maximum levy tolerated by the voters. Property tax used for streets compete with other city services, such as parks, libraries, and law enforcement.

HIGHWAY SYSTEMS USED IN OTHER STUDIES

The Federal Highway Administration, in its working paper 15, "State Highway Cost Allocation Methods - A Survey of Recent Studies," noted that some states limited the highway systems or jurisdictional costs covered. Georgia, Kentucky, and Wyoming confined their analysis to the State Highway System only. The Minnesota study covered expenditure programs and fees impacting on the highway fund. The Florida study included user taxes directly allocated to the Transportation Fund. No limitations, as to highway systems, expenditures, or revenues, were noted for other state studies.

The December 1982 Wisconsin Study, included only the user taxes "...intended to generate income for Wisconsin's Transportation Fund over and above the cost of administering or regulating the program or service."

SUMMARY

The 1982 Federal Cost Allocation Study was limited to the national highway system financed in part by the National Trust Fund. Several states limited their studies to state highway systems only. Some states limited their studies on the basis of expenditures and revenues.

RECOMMENDATIONS

Even though a comprehensive highway cost allocation study would be invaluable, the proposed Kansas study should be restricted to the state system for the following reasons:

1. Data Insufficiency - Gross assumptions as to vehicle types, weights and miles traveled on county roads and city streets would have to be made.

2. Purpose of Study - The primary purpose is to provide the legislature with information on the state system.

3. Methodology Development - A cost allocation methodology will need to be developed for the Kansas study. The methodology would be far more complex if property taxes are included. A data collection methodology would be needed to identify funds collected by property tax for counties and cities. Information as to the types and costs of road and street construction and maintenance would be needed. Debt service requirements for existing bonds would be needed. Considering the numbers of counties and cities involved, this data collection methodology would probably be possible only through a statistical sampling technique.

However, counties and cities should be included in the next Kansas cost allocation study. The next study would probably be four years after completion of this study. Oregon (probably the most experienced state in cost allocation studies) believes that there is sufficient change in programs, vehicles and revenues to warrant a study every four years.

TABLE 1

1981 COUNTY ROAD AND BRIDGE MILL LEVY

KSA 79-1947 = 10.00 mills
COUNTY UNIT COUNTIES
(68)

*Allen - 8.170
*Anderson - 8.000
*Bourbon - 6.166
*Chase - 6.790
Chautauqua - 12.650
*Cherokee - 5.710
*Cheyenne - 7.360
*Clark - 5.370
Cloud - 13.240
*Coffey - 6.418
*Comanche - 8.000
*Crawford - 7.703
*Doniphan - 9.000
*Elk - 8.000
*Ellis - 7.390
*Finney - 9.990
*Franklin - 7.000
*Geary - 5.120
*Gove - 6.357
*Graham - 1.000
*Miami - 9.000
*Montgomery - 7.384

Morris - 13.000
*Morton - 5.600
*Neosho - 8.000
*Ness - 5.660
Norton - 10.720
Ottawa - 13.000
*Phillips - 7.300
*Pratt - 7.600
Rawlins - 15.460
Republic - 12.270
*Rooks - 9.830
*Grant - 4.210
Gray - 13.500
*Greeley - 6.789
*Hamilton - 8.800
*Harper - 7.070
*Haskell - 8.720
*Hodgeman - 8.000
Jackson - 10.820
Jefferson - 14.000
Jewell - 12.240
*Johnson - 1.710
*Kearny - 7.150

*Kiowa - 5.096
*Labette - 7.321
Lane - 10.500
*Leavenworth - 3.000
*Lincoln - 9.150
*Linn - 9.000
*Lyon - 9.000
Marion - 11.260
Rush - 12.260
*Saline - 8.022
*Scott - 5.370
*Seward - 5.980
Sheridan - 12.660
*Sherman - 7.890
Smith - 10.470
*Stanton - 8.400
*Stevens - 5.620
*Trego - 8.000
*Wallace - 7.000
*Wichita - 7.000
Wilson - 16.260
Woodson - 13.000
*Wyandotte - 2.746
AVG. = 8.416 mills

KSA 79-1947 = 5.00 mills
NON-COUNTY UNIT COUNTIES
(37)

*Atchison - 4.000
Barber - 7.060
*Barton - 3.908
Brown - 11.790
*Butler - 2.854
Clay - 8.000
*Cowley - 4.270
Decatur - 6.860
Dickinson - 8.000
*Douglas - 2.806
*Edwards - 3.850
*Ellsworth - 2.670

*Ford - 1.000
Greenwood - 8.000
*Harvey - 4.580
*Kingman - 2.170
*Logan - 4.230
Marshall - 7.000
McPherson - 7.500
*Meade - 3.500
Mitchell - 8.510
Nemaha - 9.000
Osage - 6.350
*Osborne - 4.000
*Pawnee - 4.650

Pottawatomie - 9.250
*Reno - 3.000
*Rice - 3.990
*Riley - 3.340
Russell - 9.000
*Sedgwick - 3.922
*Shawnee - 3.093
Stafford - 6.000
Sumner - 5.940
Thomas - 9.590
Wabaunsee - 9.000
*Washington - 2.920
AVG. = 5.557 mills

*LEVYING LESS THAN MAXIMUM ALLOWED BY K.S.A. 79-1947

TABLE 2

TAX LEVIES, NO-FUND WARRANTS, BONDS

68-559a	For Special Road & Bridge Fund; 1 mill.
68-578 to 579	No-fund warrants; certain counties; 2 mills.
68-581 to 584	Primary arterial route designation, financing; certain counties.
68-586 to 588	Counties 130,000 to 170,000; highway bonds; election, bond debt limitation; contracts and standards.
68-5100	County road levy - 5 mills; exempt from levy limitations
68-141g	25% Budget transfer to Spec. Road, Bridge; or machinery, equipment or bridge building fund.
68-589 to 590	Special Highway Improvement Fund - 25% of budget to; budget effect.
68-596	County road levy - 5 mills on property outside of cities (only 1 mill subject to aggregate tax levy limitation). Note: For Bridge Bonds see Bridge Section.
68-1135	Special Bridge Fund - 2 mills.
74 Sess. Law Ch. 102	5 mill levy for construction and maintenance of roads (additional levy). Not under tax lid; election.
10-101 to 133	General Bond Law
	Bridge Bonds - Any County; Petition; Election.
10-201 to 205	Bridge Bonds - Same; Elections; Petitions; Joint Projects; Sealed Bids; plans and specifications.
10-301	Limitation of Bonded Indebtedness - Counties; exceptions.
79-1945 to 1947	Limitation on Tax Levies by Counties.
79-2929	Proposed budget review; public hearing notice.
79-2934 to 2936	Budget limitations; exceeding budget unlawful; exceptions.
79-2938	No-fund Warrants; when, limitation board of tax appeals.

TABLE 2 (CONTINUED)

TAX LEVIES, NO-FUND WARRANTS, BONDS

79-2939	Emergency No-fund Warrants; when, limitation, procedures, etc.
79-2964 to 2967	County & City Revenue Sharing Fund.
79-3096	$3.5 million for state gas tax to match F.A.
79-3425c	Apportionment for Special City & County Highway Fund and County Equalization & Adjustment Fund.
79-5001 to 5010	Aggregate Tax Levy Limitations.
79-5011	Tax levies exempt from aggregate limitations.
79-5012	Suspension of aggregate tax levy limitation; election required.
79-5013	Tax levies in excess of aggregate limitation, authorization by board of tax appeals.
79-5014	No-fund warrants authorized only in extreme emergency.
68-151f	Certain counties between 175-250,000, roads and bridge bonds.
68-151g	Certain counties under $50 million; road and bridge bonds.
68-151k to l	Certain counties over 175,000; Master Highway Development Plan; R/W widths; bonds.
68-151m to n	Certain counties No-fund warrants and tax levies.
68-151o	Certain counties authorized to expend reimbursements without regard to budget limitations.

REVIEW PROCESS
LOCAL ROAD ISSUE

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL REVIEW ADJUSTMENTS
Property Tax The task force stated that a cost allocation methodology would be far more complex if property taxes were included.	The task force concurred with a commenter who advised that a brief description of the level of difficulty should be included.	

end of appendix f   blank on purpose

APPENDIX G
IMPLEMENTATION PROCEDURES FOR ALLOCATION OF MAINTENANCE COSTS

Maintenance budgets consist of both contractual and non-contractual expenditures. The contractual maintenance expenditures generally consist of seals, bridge repairs, bridge painting, and comparable work intended to preserve the roadway and structures. These expenditures are generally included in the construction program and will be allocated as a part of the construction program.

The non-contractual expenditures of maintenance budgets consists of maintenance activities performed by state forces, which consist of three categories: OVERHEAD COSTS, COMMON COSTS and ATTRIBUTABLE COSTS. The overhead cost category is either not affected or only marginally by changes in vehicle travel and include activities such as training, meetings, leave, administration, and equipment, building, and land maintenance. The remaining two categories, common costs and attributable costs, are functions of vehicle use but at a different level. Common cost activities are functions of vehicle use in providing guidance to drivers, enhancement of roadside aesthetics, and providing driver/passenger comfort and safety. Common costs include activities such as mowing, roadside repairs, traffic control, and motorist services and are shared by all vehicles in proportion to their use of the system. The class of vehicle has little, if any, effect on level of service of common cost activities. For this reason, the cost allocator for common cost maintenance activities will be VMT. Attributable cost activities are caused or aggravated by physical effects of vehicles interacting with the roadway. Attributable cost activities include items such as pavement, shoulder, and bridge repairs. Vehicle weight, width, axle loadings, and use have significant effect on level of service of attributable cost activities. Vehicle weights and axle loadings affect pavements, shoulders, and bridges. Vehicle width affects pavements and shoulders and has a major effect at the interface between pavement and shoulders. For these reasons, a cost allocator sensitive to weight, widths and use is required. The ton miles traveled (TMT) allocator was selected because heavier vehicles are also generally wider vehicles. Maintenance activities will be allocated by the following procedure:

1. All vehicles will be responsible for common cost activities on the basis of VMT.

2. All vehicles will be responsible for attributable cost activities on the basis of TMT.

3. Overhead cost activities will be prorated to common and attributable costs.

Other cost allocators considered for attributable cost activities included the judgmental approach, axle miles traveled (AMT), and equivalent single axle loadings (ESAL). In the judgmental allocation technique, a panel of experts is polled to determine the need in its opinion for maintenance created by various classes of vehicles. Although the judgmental technique was not adopted, the technique is conceptually acceptable inasmuch as physical effects of vehicles interacting with the roadway are recognized, but are often difficult to quantify. Axle miles traveled (AMT) was also considered as an allocator for attributable cost maintenance activities. The reason for consideration was that vehicles with more than two axles will wear the roadway more than those with only two axles. As examples, polishing of pavement surface, wearing of pavement markings, and progressive growth of pot holes are all functions of axle passages and impacts. However, axle miles traveled does not sufficiently recognize the weight factor. The ESAL-miles allocator was also considered but was not adopted. Each vehicle has an equivalent single axle load which is a function of axle loadings and spacings. The ESAL-miles allocator would be conceptually acceptable for traffic related activities. It recognizes that axle loadings contribute to the need for maintenance. However, the weight factor is overemphasized and would more equitably be measured by the TMT allocator. Table 1 lists maintenance work categories and classifies them by overhead cost, common cost and attributable cost activities.

TABLE 1

MAINTENANCE WORK CATEGORIES

OVERHEAD COST ACTIVITIES	COMMON COST ACTIVITIES	ATTRIBUTABLE COST ACTIVITIES
Training	Detours	Pavements
Meetings	Drainage	Shoulders
Leave	Emergency Operations	Bridges
Administration	Roadside and Landscape	Striping and Marking
Equipment Maintenance	Spraying	Traffic Control Services
Building Maintenance	Signs and Markers	Motor Carrier Stations
Land Maintenance	Snow and Ice	
	Lighting	
	Longitudinal Barriers	
	Rest Areas	
	Fencing	
	Litter Pickup	
	Motorist Service	
	Park Roads	

The Bureau of Construction and Maintenance thoroughly reviewed FY 1982 non-contractual expenditures and grouped the activities into maintenance work types and determined the actual expenditures. A similar review is in progress for FY 1983 and will be utilized when available. Table 2 lists the maintenance work types by cost categories both by dollars and by relative percentages. The table also shows the adjusted common and attributable costs after proration of overhead costs.

The interstate system accounts for 9.56 percent of the FY 1982 non-contractual expenditures with the non-interstate system responsible for the remaining 90.44 percent. Common costs, after proration of overhead costs, accounted for 48.11 percent of the FY 1982 non-contractual expenditures with attributable costs responsible for the remaining 51.89 percent.

Table 2 and the conclusions reached from Table 2 are intended to be illustrative of the process which will be used to allocate maintenance costs. The relative proportions of overhead, common, and attributable costs will incorporate FY 1983 non-contractual maintenance expenditures when available. These relative proportions will be used to disaggregate the projected budgets for the four year study period (FY 1985 through FY 1988). The FY 1985 through FY 1988 maintenance expenditures were estimated by the Bureau of Management and Budget on December 20, 1984. The primary source document was the submitted FY 1986 Budget Document. Table 3 lists the Maintenance expenditures.

TABLE 2

1982 FISCAL YEAR MAINTENANCE COSTS*

MAINTENANCE WORK TYPES	OVERHEAD COSTS			COMMON COSTS			ATTRIBUTABLE			GRAND TOTALS		
	INTERSTATE	NON-INTERSTATE	TOTAL	INTERSTATE	NON-INTERSTATE	TOTAL	INTERSTATE	NON-INTERSTATE	TOTAL	INTERSTATE	NON-INTERSTATE	TOTAL
Concrete Traveled Way							456,672	948,252	1,404,924	456,672	948,252	1,404,924
Bituminous Traveled Way							387,908	12,473,461	12,861,369	387,908	12,473,461	12,861,369
Shoulders							101,368	2,339,139	2,440,507	101,368	2,339,139	2,440,507
Bridges							286,412	1,121,599	1,408,011	286,412	1,121,599	1,408,011
Roadside				265,718	4,847,832	5,113,550				265,718	4,847,832	5,113,550
Traffic Control				771,138	5,070,815	5,841,953				771,138	5,070,815	5,841,953
Motorist Services				761,278	5,005,982	5,767,260				761,278	5,005,982	5,767,260
Special Individual Projects	17,742	116,869	134,611							17,742	116,869	134,631
Administrative Development	33,468	220,492	253,960							33,468	220,492	253,960
Administration	549,651	3,621,219	4,170,870							549,651	3,621,219	4,170,870
Equipment Repair	274,854	1,810,801	2,085,655							274,854	1,810,801	2,085,655
Building and Land Maintenance	218,125	1,437,058	1,655,183							218,125	1,437,058	1,655,183
Grand Totals	1,093,840	7,206,439	8,300,279	1,798,134	14,924,629	16,722,763	1,232,361	16,882,451	18,114,831	4,124,334	39,013,519	43,137,873
Percent	2.536	16.705	19.241	4.168	34.598	38.766	2.857	39.136	41.993	9.561	90.439	100
Overhead Costs Prorated to Common and Attributable Costs (Prorated Percent)	---	---	---	5.67	42.44	48.11	3.89	48.00	51.89	9.56	90.44	100

*Data Source - Scott Mobley - October 27, 1982

TABLE 3

MAINTENANCE EXPENDITURES

FISCAL YEAR	AMOUNT
1985	$ 69,917,098
1986	72,425,431
1987	76,263,979
1988	80,534,762
Total	$299,141,270

end of appendix G   blank on purpose

APPENDIX H
IMPLEMENTATION OF THE MINIMUM PAVEMENT TECHNIQUE

INTRODUCTION

The selection of the appropriate allocation method for pavements seeks to emulate the design procedure used by the Kansas Department of Transportation.

New pavements on the State Highway System are designed using (1) traffic volume expressed in 18-kip equivalent single axle loadings (ESAL), (2) pavement and subgrade design characteristics, and (3) the costs of alternative pavement types. Eighteen kip equivalent axle loadings are determined by the Bureau of Transportation Planning using the results of in-house traffic forecasts and the equivalency formulae developed from the AASHO Road Test in the early 1960's. Expected subgrade conditions are determined by analyzing the results of soil surveys made along the highway alignment and laboratory testing on samples obtained during the soil survey. The design characteristics of pavement materials have been developed in the past using the results of an extensive testing program on typical representative materials. The economic analysis of alternative pavements is made using unit costs of recent construction in the vicinity of the project.

In order to allocate pavement costs as accurately as possible in a cost allocation study, a best estimate of pavement types and thicknesses for each project or category of projects in the program must be determined. Likewise, whether a project will consist of new pavement or overlay as well as the pavement type must be determined. Obviously, the actual pavement type, thickness, and concept will not be known until the preliminary engineering and design are completed on each project.

An alternative to evaluation of individual projects is the analysis of an inclusive set of typical pavement design parameters to develop an average pavement thickness. While this could be easily done, it is a less realistic way of approaching the problem when the probable project locations are known as they are for this study.

DEFINITION OF TERMS

A basic pavement or overlay is one that has adequate width and thickness to carry a minimal number of basic vehicles for a standard design term. The pavement thickness will have sufficient strength to resist the traffic loads imposed by the basic vehicles and the effects of the environment.

The surfacing on all new construction projects, most major reconstruction, and some rehabilitation projects will be new pavement. A new pavement is defined for this study as one which is constructed from the ground (subgrade) up.

The surfacing on all preservation projects will be designated as overlays. An overlay is defined as the addition of a surfacing layer(s) to an existing pavement to preserve and/or strengthen it. A portion but not all of the existing surface may be utilized (recycled) for the overlay or related work.

New Construction or Major Reconstruction projects are those on new location or those that result in substantial change in the vertical or horizontal alignment as compared to the existing facility.

Rehabilitation projects are those that result in considerable improvement of structural or functional features and substantially retain the existing vertical and horizontal alignment of the existing facility.

Preservation projects are those that result in little or no functional or structural improvement and retain the existing alignment. They are primarily undertaken to extend the life of the existing physical features, i.e. surface and shoulders. Preservation projects are different from routine maintenance projects which are aimed primarily at retarding normal deterioration or correcting seasonal or unexpected problems such as damage from accidents, vandals, or floods.

CURRENT KDOT DESIGN PRACTICE

The KDOT has formal procedures for the design of new flexible and rigid pavements. The flexible design method is semi-empirical and utilizes triaxial test results in the analysis. This method with certain modifications has been in use for nearly 40 years. Current pavement design practice specifies a minimum pavement thickness of six inches of asphaltic concrete for new pavements for highways on the State system. This thickness is used when traffic levels are low and/or subgrade soils are very good. The minimum thickness evolved over the years as the thickness necessary to carry the traffic and resist the environment for the ten-year design term used. Although the traffic for the minimum design is light, it assumes some trucks with single wheel loads of up to 4500 pounds. This has been the practice for over 20 years with few exceptions. Flexible pavement thicknesses increase with worsening soil type, increasing traffic load and/or increasing rainfall up to a practical maximum thickness dictated by the cost of an equivalent rigid design. Pavements up to 20 inches thick have been constructed.

Most rigid pavements have been built on roadways with moderate to heavy traffic in the eastern half of Kansas. The interim rigid pavement design procedure currently used is an adaptation of several national methods to Kansas conditions developed in early 1984. The procedure allows for either jointed reinforced or jointed plain concrete pavements with traffic restrictions on each. Thicknesses allowed by the procedure range from 7 to 11 inches. In all but the lowest traffic range, pavements are constructed with 4-inch Portland Cement or 4-inch bituminous stabilized bases. With Kansas soil conditions and normal base design features practically all pavements will be 8, 9, or 10 inches thick.

Depending upon the project category, overlays may be designed using a formal design procedure. Currently, overlay thicknesses for the 1R programs are determined primarily by field observation and a review of field data by experienced personnel who then select one of several typical designs. Overlays on projects in the 3R, interstate, statewide or freeway programs are generally designed based on an evaluation of engineering data using rational design methods such as those developed by AASHTO or The Asphalt Institute.

The pavement and overlay design procedures described above are in the process of being changed. A Pavement Management System (PMS) is currently in the third of five phases of development. When completed in 1986, the PMS will have comprehensive design procedures for new flexible and rigid pavements as well as design procedures for rehabilitation of existing pavements of both types.

ALLOCATION METHOD FOR PAVEMENTS

After a thorough evaluation of the allocation methods used in other federal and state allocation studies, the minimum pavement thickness method was adopted for use both for new pavements and overlays.

The minimum thickness is the thickness required to resist the environment for the standard design term. This thickness will also provide service to a small number of vehicles during the design life. The additional thickness is that required to provide service for all vehicles for the standard design term. The minimum thickness will be allocated using the vehicle miles traveled allocator. The additional thickness will be allocated using the ESAL-miles allocator. Extra pavement width (2 feet of 24 feet) will be allocated using the same allocators but only wide vehicles will be assessed. The method is presented visually in Figure 1.

SELECTION OF THE MINIMUM PAVEMENT THICKNESS

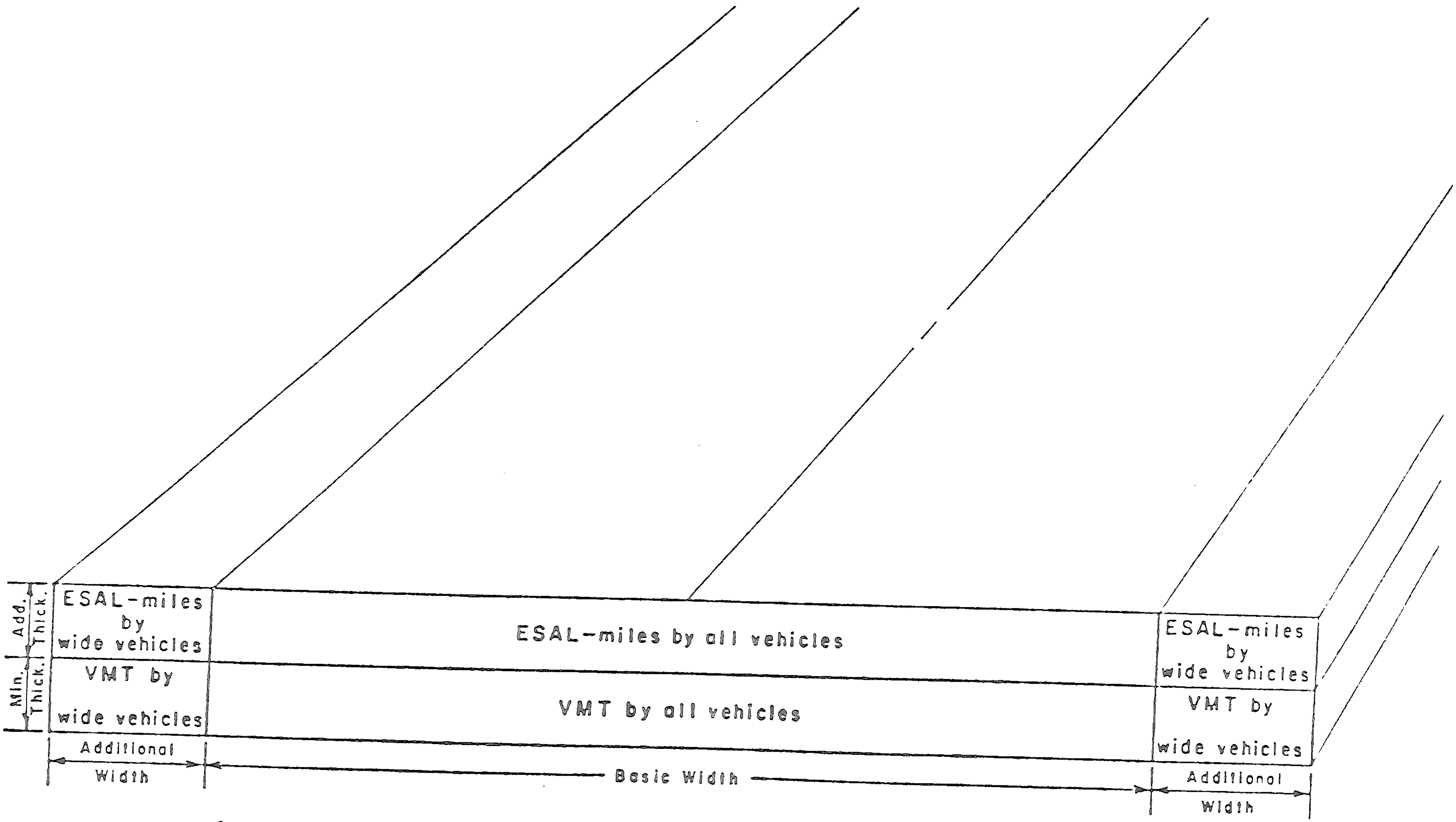
The Cost Allocation Task Force has selected the minimum pavement thickness method for allocating new pavements in the Kansas Study. To use this method, the thickness of the minimum pavement must be determined for both flexible and rigid pavements. The minimum pavement thickness for the basic road on the state system must have sufficient strength to resist the traffic loads imposed by a small number of vehicles and the effects of the environment over the standard design term. In order to select the appropriate minimum pavement thickness, the AASHTO Interim Guide, the 1982 Federal Highway Cost Allocation Study and current KDOT practice were reviewed.

The AASHTO Interim Guide, page 24, recommends a minimum thickness of two inches for the surface course and four inches for the base course. For rigid pavements, it recommends eight inch minimum slab thicknesses on page 31 except on roads with light traffic. Nomographs and tables on pages 29, 32, and 34 are developed for slab thicknesses as low as six inches.

The 1982 Federal Study utilizes the minimum thicknesses presented in the AASHTO Interim Guide. The thicknesses are reiterated on page D-5 of the Final Report.

Current KDOT practice for new pavements on the State system is to construct a minimum bituminous pavement thickness of six inches. With few exceptions, this has been the practice since the policy to construct full depth asphalt pavements was made over 20 years ago. The vast majority of rigid pavements constructed by the KDOT on the State system have been nine inches thick. The reason for this is that economics have usually required that concrete pavements be constructed on higher traffic routes in poor soil areas. The current rigid design procedure allows a minimum thickness of seven inches for twenty year cumulative traffic levels less than 3.9 million ESAL's. This traffic level is much higher than the lowest level used for flexible pavements and thus is not representative of a basic service pavement.

After a review of AASHTO recommendations and current KDOT policy, six inches will be used as the minimum pavement thickness for both rigid and flexible pavements in the Kansas Study.



MINIMUM PAVEMENT ALLOCATION TECHNIQUE

Figure No. 1

A 3/4-inch overlay is the minimum currently used by the Kansas Department of Transportation. Its use is predicated on the minimum practical thickness which can be constructed. The Federal Highway Administration also defines a 3/4 inch overlay as the minimum thickness for 3R construction on page two of a Federal Highway Administration Notice (N 5040.19) titled Resurfacing, Restoring, and Rehabilitation (R-R-R) Work dated June 28, 1976. No written Kansas Department of Transportation directive on this subject is known to exist. A 3/4-inch overlay thickness will be used as the minimum or basic thickness in the Cost Allocation Study.

SELECTION OF PAVEMENT TYPE

A method to determine the expected type of pavement (rigid or flexible) for each new pavement and overlay must be developed so that appropriate thicknesses can be determined. This is necessary because the thickness design procedures for each type is different both in principle and in practice. While historic records could have been analyzed to determine what percentage of each type has been constructed in the past, this was not recommended because of the changing mix of projects and the recent change in some design philosophies by the Kansas Department of Transportation. The pavement types currently shown on plans or Surfacing Committee reports were used if available. If this information was not available, the type was selected by an experienced engineer using information available from the 883 forms and other sources.

SELECTION OF PAVEMENT THICKNESSES FOR NEW PAVEMENTS

RIGID PAVEMENTS. Traditionally, almost all Portland Cement concrete (rigid) pavements have been constructed nine inches thick by the Kansas Department of Transportation on the state system. Certain extremely high traffic routes have been constructed with ten-inch pavements and few low traffic routes on good soils with eight-inch pavements. The interim design procedure currently in use allows more 8 and 10-inch pavements to be designed and potentially some 7 and 11-inch pavements.

Actual design thicknesses will be used if available. For those projects without pavement designs completed, the design chart shown below will be used.

		Traffic Range/Cumulative ESAL in Millions*				
Subgrade	Type	I	II	III	IV	V
Support		≤ 3.9	4.0-5.9	6.0-9.9	10.0-20.0	> 20.0
Ke ≤ 250	JPCP	8"	10"	-	-	-
	JRCP	-	9"	9"	10"	11"
Ke > 250	JPCP	7"	9"	10"	-	-
	JRCP	-	8"	8"	9"	10"

*Two-way Traffic
JPCP = Jointed Plain Concrete Pavement
JRCP = Jointed Reinforced Concrete Pavement

Typical soil strength parameters for use with the AASHTO Interim Guide have been developed by Gisi utilizing earlier work done by Maag and Worley. These values are used primarily for planning purposes. Values for the modulus of subgrade reaction for typical Kansas soils with and without treated bases are shown below for the areas shown on Figure 2.

Area	Modulus of Subgrade Reaction (Ke)	
	Raw Soil	Raw Soil with 4" Treated Base
A	250	425
B	200	360
C	175	330
D	150	300
E	100	240
F	75	195

For purposes of the Cost Allocation Study, rigid pavements will all be designed with a 4 inch treated base using these Ke values. Cumulative traffic will be determined using traffic data from the CANSYS data base. Jointed plain concrete pavement (JPCP) will be selected over reinforced pavements for all traffic levels allowed.

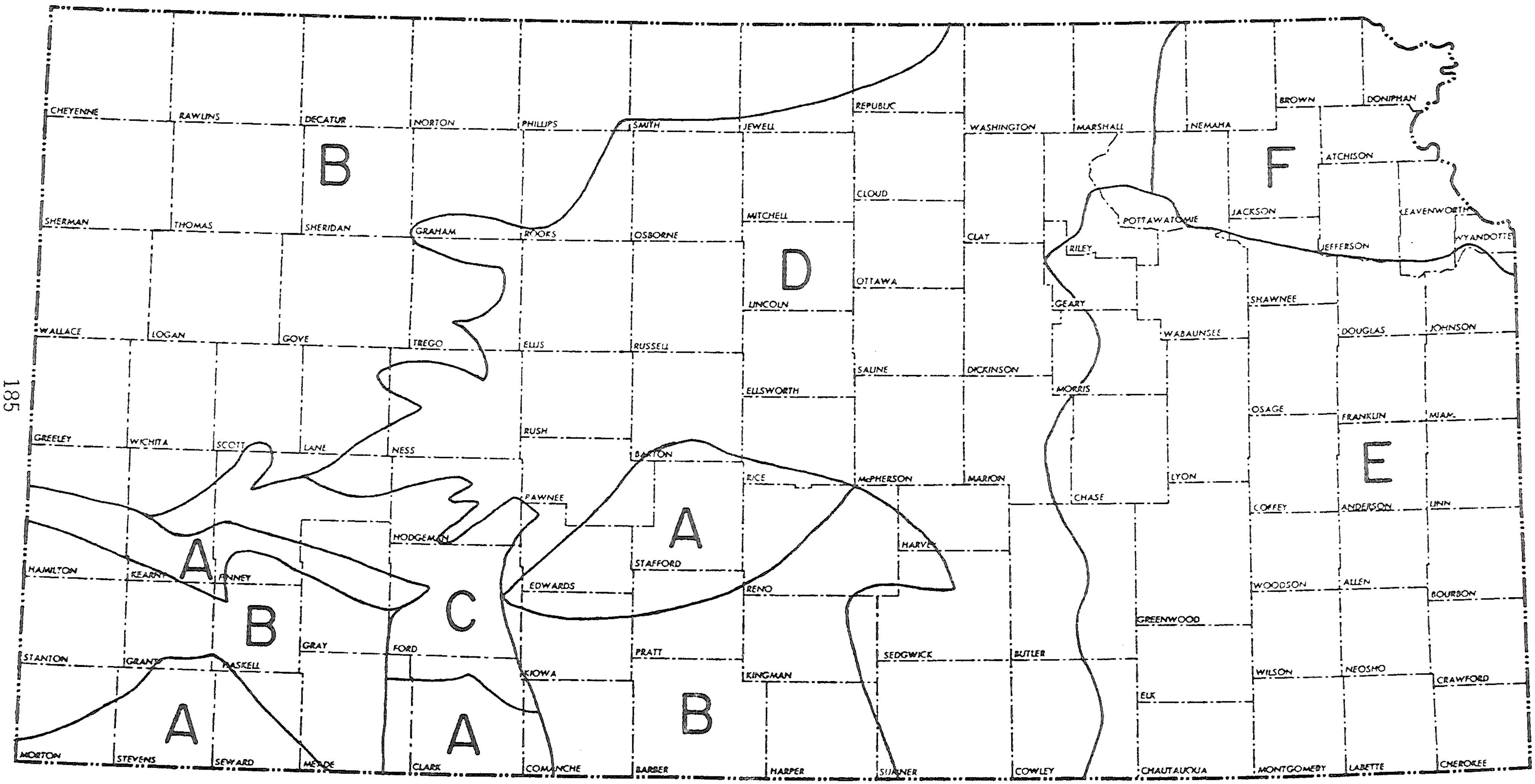
Almost all rigid pavements constructed on the state system now utilize four-inch treated bases to improve performance of the pavement slab by lessening pavement deflections at the joints. Since the principles of rigid design are different than flexible design, the treated base is included in the design by varying the subgrade strength (Ke). A study was made to determine the structural strength of the treated base so that it could be added to the calculated average pavement thickness to develop the allocation percentages. Although the purpose of the four-inch treated base is not entirely related to the increase in subgrade strength provided, this reason was chosen as the best way to develop an equivalency for cost allocation purposes.

In order to define the thickness difference, actual thicknesses usually constructed were analyzed. Using eight, nine and ten-inch slab thicknesses which will be constructed, equivalent slab thicknesses were calculated using the nomograph for Pt = 2.5 from the AASHTO Interim Guide (1981 revised). The results are shown below:

Ke Raw Soil With 4" Tr. Base (TB)	Ke Raw Soil Only (RS)	D_{TB}	D_{RS}	D_{TB}	D_{RS}	D_{TB}	D_{RS}
195	75	8	8.6	9	9.6	10	10.5
240	100	8	8.5	9	9.5	10	10.5
300	150	8	8.4	9	9.4	10	10.4
330	175	8	8.4	9	9.4	10	10.4
360	200	8	8.4	9	9.4	10	10.4
425	250	8	8.4	9	9.4	10	10.4

The average of the difference between the thicknesses with and without the treated base is 0.44 inches. This thickness will be added to the average slab thickness for all projects before allocation percentages are calculated.

KANSAS



Maag, 1971

GENERAL SOIL STABILITY MAP

Figure 2

FLEXIBLE PAVEMENTS. A method to determine the thickness of flexible pavements without detailed engineering test data is much more difficult than for rigid pavements since flexible pavements are much more sensitive to traffic levels, soil type, and climate. Many of the projects in the four year program have the pavement design completed. The actual design thickness was used if available. In order to provide a realistic pavement thickness for the remaining projects without extensive analysis, a typical pavement thickness table (Table 1) was developed from earlier work by Maag, 1971. Figure 2 depicts the general soil areas associated with Table 1. For those flexible pavement projects without available information, the thicknesses were taken from Table 1. Traffic data was obtained from the CANSYS data base maintained by the Bureau of Transportation Planning.

Some flexible pavements in eastern Kansas are designed with lime treated subgrades. Lime treated subgrades are constructed six inches thick and function as a structural layer below the flexible pavement. Flexible pavements are generally reduced two inches in thickness when a lime treated subgrade is specified. In order to treat flexible pavements across the State equitably, two inches were added to the pavement thickness for those projects designed with lime treated subgrade. The thicknesses in Table 1 were used directly since a reduction for lime treatment was not considered in their development.

TABLE 1

TYPICAL PAVEMENT THICKNESS
(BASED ON KDOT DESIGN METHOD)

Traffic Range (ESAL/Day)	Area from Figure 2					
	A	B	C	D	E	F
1-25	6.0	6.0	6.0	6.0	6.0	6.0
26-40	6.0	6.0	6.0	6.0	6.5	7.0
41-60	6.0	6.0	6.5	7.5	8.5	9.0
61-90	6.0	6.5	7.5	8.5	10.0	10.5
91-135	6.5	7.5	9.0	10.0	11.5	12.5
136-200	7.5	8.5	10.0	11.5	13.0	14.0
201-300	8.5	9.5	11.0	12.5	14.5	16.0
301-450	9.5	11.0	12.0	13.5	16.0	17.5
451-675	10.5	12.0	13.5	15.0	17.5	19.0
676-1000	11.5	13.0	14.5	16.5	19.0	21.0
1001-1500	12.5	14.0	15.5	18.0	20.0	22.5
1501-2250	13.5	15.0	16.5	19.0	21.5	24.0

Adapted from Maag, 1971

SELECTION OF OVERLAY THICKNESSES

The vast majority of all overlays designed by the Kansas Department of Transportation are constructed using bituminous materials. Overlay thicknesses range from 3/4 inch up to eight inches or more.

For surface preservation projects (1R program), the standard overlay thicknesses are usually 3/4 or 1-1/2 inches. An overlay thickness of two inches was used for surface recycling projects (mill 1", overlay 2") based on actual practice as defined in the Administrative Instruction entitled "Recycling Guidelines". Conventional seal projects were included with a 3/8 inch thickness. Projects with heater scarification were included with a thickness of 3/4 inch plus the overlay thickness indicated.

For those rehabilitation and major reconstruction projects with overlays, the overlay thickness will be the actual design thickness. If the actual design thickness has not been developed, the preliminary thickness will be taken from the 883 form or developed by an engineer familar with pavement design. Some major reconstruction projects are split into new pavement and overlay sections. These projects were split to the extent possible from information available.

CALCULATION OF THE AVERAGE PAVEMENT THICKNESS

The allocation techniques were developed for standard two-lane projects. In order to weight the pavement thicknesses so that a realistic average was obtained, all projects were weighted as to the number of lanes and length. Multi-lane facilities were weighted by the number of lanes divided by two. For example, a one-mile long six-lane interstate surfacing project was considered to be equivalent to a three-mile long two-lane project.

The following table shows the average thickness used for allocation. Values were calculated from a data file of projects using SAS computer software. The table is tentative and reflects the design information available at this time. The Cost Allocation Study will utilize the latest design data available, which may change the average thickness shown in the table.

Pavement Category	Average Thickness (In.)
New Flexible	11.64
New Rigid	9.81
Surface Preservation	1.12
Overlay	3.00

The rigid pavement thickness includes 0.44 inches for four-inch treated bases.

Using the above averages and the pavement width considerations discussed earlier, the following percentages were developed for pavement cost allocation purposes.

	Basic Thickness		Additional Thickness	
Pavement Category	Basic Width	Additional Width	Basic Width	Additional Width
New Flexible	47.25%	4.30%	44.42%	4.03%
New Rigid	56.06%	5.10%	35.60%	3.24%
Surface Preservation	61.38%	5.58%	30.29%	6.25%
Overlay	22.92%	2.08%	68.75%	6.25%

TYPICAL 18-KIP EQUIVALENT SINGLE AXLE LOAD (ESAL) VALUES

Typical 18-kip equivalent single axle load values for each vehicle category were developed for both flexible and rigid pavements for the study. These values are multiplied by the vehicle miles traveled by each vehicle category to create the ESAL-miles allocator. A typical ESAL value for each vehicle class was developed from truck weight data in the 1983 Truck Weight Study prepared by the Bureau of Transportation Planning and values used in the 1982 Federal Study for Region 3, which included Kansas. The values used are shown in Table 2.

The following parameters were used for the calculations: Flexible: SN = 4, p = 2.5; Rigid: D = 9", p = 2.5. These parameters were selected because they appropriately represent the average thicknesses calculated. The structural number (SN) is calculated from structural layer coefficients that are assigned to different types of flexible pavement layers. Using typical layer coefficients, a SN of 4 is equivalent to an 11-inch full depth asphaltic concrete pavement. The D value for rigid pavements is the actual slab thickness. The p value is a present serviceability index chosen between a range of one and five with the latter representing a perfect new roadway. For high type roadways such as those considered in this study, a value of 2.5 is traditionally used as the condition which warrants rehabilitation.

The results are not influenced significantly by a change in these parameters as a limited analysis of various axle weights shows in Table 3. Values for all axle weights for these parameters are shown in Table 4. Examples of how axle load values are converted to vehicle values are shown in Table 5 for several truck types. The axle weights used in these examples are hypothetical but show the influence of single and tandem axles on vehicles with the same total weights.

TABLE 2

ESAL VALUES BY VEHICLE CATEGORY

DESCRIPTION	CATEGORY	FLEXIBLE PAVEMENT ESAL SN=4, p=2.5	RIGID PAVEMENT ESAL D=9", p=2.5
STD AUTO	1	0.00012	0.00010
SM-AUTO	2	0.00010	0.00010
MOTORCYCLE	3	0.00001	0.00001
INTERCITY BUS	4	0.39880	0.54670
TRANSIT BUS	5	0.27030	0.29630
SCHOOL BUS	6	0.58870	0.79540
SU-4TIRED <6	7	0.00090	0.00080
SU-4TIRED 6 to 10	8	0.00860	0.00170
SU-4TIRED >10	9	0.02140	0.00534
SU-6TIRED <19.5	10	0.04340	0.01879
SU-6TIRED 19.6 - 26	11	0.23790	0.17780
SU-6TIRED >26	12	0.31930	0.22774
SU-3AX <26	13	0.30970	0.44230
SU-3AX 26 - 33	14	0.64150	0.99670
SU-3AX 33 - 40	15	0.57490	0.62170
SU-3AX 40 - 50	16	0.70212	0.82535
SU-3AX >50	17	0.67230	0.96150
COMB-3AX <26	18	0.14460	0.11937
COMB-3AX 26 - 50	19	0.38060	0.35019
COMB-3AX >50	20	0.40300	0.30948
COMB-2S2 <50	21	0.18690	0.17400
COMB-2S2 50 - 60	22	0.57929	0.66881
COMB-2S2 >60	23	0.79862	0.63884
COMB-4AX <50	24	0.23510	0.17717
COMB-4AX 50 - 60	25	0.63380	1.41490
COMB-4AX >60	26	0.55005	0.70409
COMB-3S2 <50	27	0.56400	0.87120
COMB-3S2 50 - 70	28	1.00934	1.05392
COMB-3S2 70 - 75	29	1.01456	1.21389
COMB-3S2 >75	30	1.03362	1.51770
COMB-5AX <50	31	0.35272	0.51490
COMB-5AX 50 - 70	32	0.18598	0.23757
COMB-5AX 70 - 75	33	1.07247	1.35511
COMB-5AX >75	34	1.17920	1.37270
COMB-6AX <50	35	0.87710	1.25720
COMB-6AX 50 - 70	36	0.60120	0.79510
COMB-6AX 70 - 75	37	1.59660	1.13040
COMB-6AX >75	38	1.40460	1.12640

TABLE 3

VARIATION OF EQUIVALENT SINGLE AXLE LOADING VALUES

Axle Type/Load	SN, p_t = 2.5						D, p_t = 2.5					
	1	2	3	4	5	6	6	7	8	9	10	11
S - 2,000	+22.7 .00022	+22.7 .00022	+17.6 .00020	0 .00017	-5.9 .00016	-11.8 .00015	+10.5 .00021	+5.3 .00020	+5.3 .00020	0 .00019	+0 .00019	+0 .00019
S - 3,000	+15.9 .00080	+27.5 .00088	+15.9 .00080	0 .00069	-8.7 .00063	-13.0 .00060	+9.3 .00082	+4.0 .00078	+1.3 .00076	0 .00075	0 .00075	-1.3 .00074
S - 5,000	-1.9 .00476	+19.2 .00578	+3.1 .00550	0 .00485	-9.1 .00441	-13.4 .00420	+9.2 .00536	+4.1 .00511	+1.2 .00497	0 .00491	-0.6 .00488	-0.8 .00487
S - 10,000	-11.2 .0752	0 .0847	+6.4 .0901	0 .0847	-6.6 .0791	-10.2 .0761	+6.8 .0872	+3.7 .0838	-1.1 .0817	0 .0808	-0.5 .0804	-0.7 .0802
T - 10,000	-1.8 .00655	+19.2 .00795	+16.5 .00757	0 .00667	-9.0 .00607	-13.3 .00578	+9.7 .0136	+4.0 .0129	+1.6 .0126	0 .0124	0 .0124	-0.8 .0123
T - 15,000	-11.2 .0313	+8.0 .0376	+0.6 .0385	0 .0348	-8.0 .0320	-12.1 .0306	+7.4 .0672	+3.7 .0645	+1.1 .0629	0 .0622	-0.6 .0618	-0.8 .0617
T - 20,000	-11.3 .1034	0 .1165	+6.3 .124	0 .1166	-6.6 .1089	-10.2 .1047	+4.9 .216	+2.9 .210	+1.0 .206	- .204	-0.5 .203	-0.5 .203
T - 25,000	-9.4 .271	-3.3 .289	+2.7 .307	0 .299	-4.7 .285	-7.4 .277	+2.5 .537	+1.5 .532	+0.6 .527	0 .524	-0.2 .523	-0.4 .522
T - 30,000	-5.6 .607	-3.1 .623	+0.5 .646	0 .643	-2.5 .627	-4.4 .615	-0.9 1.131	-0.7 1.133	-0.3 1.138	0 1.141	+0.2 1.143	+0.3 1.144
Average Percent Variation	-1.5	+10.0	+7.7	0	-6.8	-10.6	+6.6	+3.2	+1.4	0	-0.24	-0.56

TABLE 4

18,000 POUND AXLE EQUIVALENCE FACTORS

GROSS AXLE LOAD (POUNDS)	FLEXIBLE PAVEMENT (SN=4, P=2.5) SINGLE AXLES	FLEXIBLE PAVEMENT (SN=4, P=2.5) TANDEM AXLES	RIGID PAVEMENT (D=9, P=2.5) SINGLE AXLES	RIGID PAVEMENT (D=9, P=2.5) TANDEM AXLES
1,000	0.00003		0.00003	
2,000	.00022		.00020	
3,000	.00089		.00076	
4,000	.00260		.00214	
5,000	.00618		.00497	
6,000	.01279		.01013	
7,000	.0239		.0188	
8,000	.0412		.0324	
9,000	.0667		.0526	
10,000	.1023	0.00850	.0817	0.0126
11,000	.150	.01241	.1220	.0182
12,000	.212	.0176	.176	.0256
13,000	.291	.0243	.248	.0353
14,000	.388	.0329	.340	.0475
15,000	.506	.0436	.457	.0628
16,000	.645	.0567	.603	.0818
17,000	.809	.0726	.782	.1050
18,000	1.000	.0917	1.000	.133
19,000	1.22	.1143	1.26	.166
20,000	1.47	.141	1.57	.206
21,000	1.76	.171	1.93	.253
22,000	2.09	.207	2.34	.308
23,000	2.47	.247	2.82	.371
24,000	2.89	.292	3.36	.444
25,000	3.37	.344	3.98	.527
26,000	3.92	.401	4.67	.622
27,000	4.52	.464	5.43	.729
28,000	5.21	.534	6.29	.850
29,000	5.93	.611	7.24	.986
30,000	6.83	.695	8.28	1.137
31,000	7.79	.787	9.43	1.31
32,000	8.85	.887	10.70	1.49
33,000	10.03	.996	12.09	1.70
34,000	11.34	1.113	13.62	1.92
35,000	12.78	1.24	15.29	2.16
36,000	14.38	1.38	17.12	2.43
37,000	16.14	1.52	19.12	2.72
38,000	18.07	1.68	21.31	3.03
39,000	20.18	1.85	23.69	3.37
40,000	22.50	2.03	26.29	3.74

TABLE 5

ESAL VALUES FOR HYPOTHETICAL VEHICLES

AXLE	AXLE TYPE	WEIGHT (LBS.)	ESAL (SN=4)	ESAL (D=9")
A	S	3,000	.00089	.00076
B	S	3,000	.00089	.00076
Total			.00178	.00152
A	S	10,000	.1023	.0817
BC	T	26,000	.4010	.6220
Total			.5033	.7037
A	S	10,000	.1023	.0817
BC	T	26,000	.4010	.6220
CD	T	26,000	.4010	.6220
Total			.9043	1.3257
A	S	10,000	.1023	.0817
B	S	13,000	.2910	.2480
C	S	13,000	.2910	.2480
D	S	13,000	.2910	.2480
E	S	13,000	.2910	.2480
Total			1.2663	1.0737

REFERENCES

1. AASHTO Interim Guide For Design of Pavement Structures (1981 Revised) by American Association of State Highway and Transportation Officials, Washington, D.C., 1981.

2. Kansas Truck Weight & Volume Study - 1983, Kansas Department of Transportation, 1984.

3. Final Report on the Federal Highway Cost Allocation Study, U.S. Department of Transportation, Federal Highway Administration, May 1982.

4. Resurfacing, Restoring, and Rehabilitation (R-R-R) Work, Federal Highway Administration Notice (N5040.19), June 1976.

5. Design of Flexible Pavements Using the Triaxial Compression Test, State Highway Commission of Kansas, Highway Research Board, Bulletin No. 8, 1947.

6. Principles of Pavement Design, Second Edition, by E. J. Yoder and M. W. Witczak, 1975.

7. Recycling Guidelines, Administrative Instruction, Kansas Department of Transportation, January 1983.

blank on purpose

REVIEW PROCESS
IMPLEMENTATION OF THE MINIMUM PAVEMENT TECHNIQUE

TASK FORCE RECOMMENDATIONS	KDOT REVIEW ADJUSTMENTS	EXTERNAL REVIEW ADJUSTMENTS
Design Procedure for Rigid Pavement The task force stated that all rigid pavements are currently constructed with a 4 inch Portland Cement treated base. Usual rigid pavement thicknesses have been 8, 9, and 10 inches depending on traffic and soil types.	The task force concurs with commenters who advised that the current design procedure for rigid pavement will permit thicknesses of 7 to 11 inches, and that in all but the lowest traffic ranges, pavements are constructed with either a 4 inch bituminous stabilized base, or a Portland Cement treated base.	
Design Procedure for Overlays The task force stated that overlay thickness for the 1 R overlay program is determined by field observation and by a review of field data.	The task force concurs with commenters who stated that the thickness selection procedure is correct, but that the Pavement Management System (PMS) is developing design procedures for overlays.	
Minimum Pavement Thickness The task force stated that the minimum pavement thickness is the thickness required to resist the environment.	The task force concurs with commenters who stated that the minimum thickness will also provide service to a small number of vehicles during the design life of the pavement.	
Minimum Pavement Overlay Thickness The task force stated that a 3/4 inch minimum overlay is predicated on Federal Highway Administration Notice (N5040.19).	The task force concurs with commenters who stated that a 3/4 inch minimum overlay is predicated on the minimum practical thickness which can be placed.	

blank page for - End Appendix H

APPENDIX I
COMMENTS FROM INTEREST GROUPS

Draft copies of "Cost Allocation Study - 1985" were circulated to the following interest groups for their review and comments:

Kansas Motor Carriers Association,
Kansas Railroad Association,
The Road Improvement Program (TRIP),
The United Transportation Union,
Kansas Highway Users Federation,
American Automobile Association of Kansas.

Comments were received from the Kansas Motor Carriers Association and the Kansas Railroad Association. Their comments, in their entirety, are included in this appendix. The task force summarized and responded to the comments in Appendix J.

blank on purpose

Mr Nick —
as we discussed
MOK

KANSAS MOTOR CARRIERS ASSOCIATION

December 27, 1985

The Honorable John Kemp
Secretary of Transportation
Kansas Department of Transportation
State Office Building
Topeka, KS 66612-1568

Dear Secretary Kemp:

I am enclosing with this letter, an analysis of the draft of the Cost Allocation Study - 1985 which was forwarded to this office November 7, 1985. We immediately requested John Reith, Director of the Department of Highway Policy, American Trucking Associations, Inc., to review the draft and forward comments to us. We received the ATA analysis during the Christmas holiday and have immediately forwarded this copy to you.

We ask that you review these comments and, at a later date, allow Mr. Reith and representatives from KMCA to sit down with the Kansas DOT staff to discuss this issue in more detail.

We believe this matter to be of the utmost importance to the Kansas Department of Transportation, to this industry, to legislators and administrators, and to our fellow highway users. We will appreciate your honest consideration of our comments accordingly.

Thank you for the opportunity to submit this analysis to you.

Cordially,

Mary E. Turkington
Executive Director

MET/sc
enc

cc: John Reith, Director, Department of Highway Policy, ATA
Carl Seaton, President of KMCA

RECEIVED

DEC 30 1985

P.O. BOX 1673 • 2900 TOPEKA AVE. • TOPEKA, KANSAS 66601 • 913-267-1641

blank on purpose

Review of Kansas Draft Highway Cost Allocation Study-1985
American Trucking Associations, Inc.
Department of Highway Policy
12/20/85

Trucking Industry Posture:

The trucking industry accepts the position that heavier and larger vehicles result in greater costs to the states than would occur if there were no such vehicles. That is the basis for the operators of heavier vehicles paying a much larger highway use tax per mile of travel than do the more numerous lighter vehicles. Thus, any disagreement about the level of truck taxes is a disagreement about "how" the truck responsibility is computed and "how" the taxes are collected, not whether there is differential responsibility.

Highways are shared use facilities which are highly efficient because the various costs of the facility can be shared among many vehicles and uses. The purpose of highway cost allocation studies (HCAS), therefore is to provide some rational and reasonable means of arriving at the proportionate share of highway program costs that the different uses and vehicles should pay through the user tax mechanism.

The trucking industry is convinced that a rational cost allocation study requires that a consistent philosophy or method of determining equity be followed, if reasonable results are to be derived. We believe that the Kansas highway cost allocation study did not follow a consistent approach, as is spelled out in more detail later in this statement. That failure to follow a standard procedure, which first occured in the Federal HCAS in 1982, has resulted in every subsequent state study incorporating major changes in cost distribution. The Kansas study devised new cost assignments which are inconsistent with those of any other HCAS.

Kansas Highway Cost Allocation Study - 1985:

The Kansas highway cost allocation study divides highway costs into three major categories, construction, maintenance and "non-construction and maintenance," with an additional separate category for freeway debt service. With the exception of freeway debt service, not included in other state studies, the cost distribution follows usual procedures up to this point.

The primary interest of the trucking industry reviewers is obviously the cost findings reported for the various combination vehicles. Accordingly, the proportion highway costs assigned to combination vehicles, as a class, was the major concern addressed below.

The following table provides the proportion of the total cost responsibility assignment to combination vehicles from each highway cost category in the Kansas study.

COST RESPONSIBILITY ASSIGNMENT TO "ALL COMBINATIONS" (Category 6-CU) BY HIGHWAY COST ELEMENT

Highway Cost Category	Dollars Assigned (x 1000)	Percent	Source
Construction	100,521	33.08	Table 3, p-38
Maintenance	77,743	25.58	Table 5, p-36
Non Const or Maint	102,298	33.66	Table 7, p-38
Freeway Debt Service	23,338	7.68	Table 11, p-42
Sum:	303,900	100.00	-
Check:	303,902	-	Table 13, p-44

In reviewing this table, it is immediately apparent that "non construction or maintenance" costs represent the largest assignment to combination trucks, more than one third of the total. This is an unusual finding for this category of highway costs, which are normally considered as mostly administration costs and allocated on a non-weight basis. From the description in the study this item apparently includes the costs of driver licensing, vehicle registration, the Motor Carrier Bureau and highway administration. In a recent Oregon study, these items represented 14% to 18% of total costs depending on the size of the total budget considered. This item represents nearly 38% of all costs assigned to all vehicles in the Kansas study. The report contains no explanation for this considerable difference. The question then is how were these costs allocated among the vehicle types?

Table 6 on page 37 provides the distribution of "non construction or maintenance" costs by the 38 specific vehicle types. These entries can be summed by vehicle type to provide the same six groupings which are presented in the other tables.

"NON-CONSTRUCTION OR MAINTENANCE" COST ASSIGNMENTS
BY VEHICLE TYPE

Vehicle Type	Motor Carrier	Driver License	Regis	Adm	Total
	%	%	%	%	%
Autos	0	65.2	65.2	38.5	39.0
Cycles	0	4.6	4.6	0.7	1.1
Buses	0	0.5	0.5	0.8	18.6
PU/Vans	0	24.7	24.7	19.2	10.7
SU Trucks	36.9	3.6	3.6	9.7	29.9
CU Trucks	63.1	1.5	1.5	31.0	29.9

Table 6 shows that Administration represents about 84% or $286.9 million of the total $342 million cost included in this item. Combination trucks, which are assigned 1 1/2% of driver license and registration cost, are charged 31% of administration costs or a total of $89 million over the study period.

A check of Table 9, page 40, column 5 "Allocated 1985-1988 Total Costs Percent" reveals that the Administration Costs in the Kansas HCAS have been assigned in direct proportion to all costs in the study. In effect, this means that administration costs are allocated in direct proportion to the vehicle weight costs derived from construction and maintenance cost. We find no rational reason for this allocation method in the report and contend that it is not justified. Although the overhead or administration costs are different in different studies, we know of no rationale which would support their allocation on a weight basis.

Table 5, page 10, provides a list of the "allocators" used in the Kansas study. It is indicated that Vehicle Miles Traveled (VMT) is used as the allocator for administration costs in one column but "percent markup" is listed under "comments".

However, in the discussion of Adminsitration costs on page 22, it is stated that "These costs will be assigned as an overhead markup to the costs allocated to the various vehicle classes." In other words, the very large Administration Cost pool is assigned in proportion to weight, without any justification.

In the Oregon study, these items are listed as non-weight related. In this Kansas study only 6% of these costs are allocated on non-weight basis.

If the administration costs were assigned by VMT as originally proposed, it would change the relative tax payment of the "combination trucks" from payment of 79% of their assigned responsibility (Table 11, page 119) to a payment of 102 percent of the assigned responsibility. Autos, as a class, would drop from 113 percent to 96 percent of meeting their responsibility.

This one small change in the distribution of administration costs to a cost allocator generally used in other studies for these expenses completely reverses the findings of this study. Instead of underpaying their cost responsibility, combination vehicles overpay their responsibility under the present tax structure.

Treatment of administration costs is not, however, the only major problem which the trucking industry has with this Kansas cost allocation study. As indicated at the outset, this study combines the traditional incremental cost allocation procedure with the new consumption approach without clear recognition that there are conceptual differences between the methods. This can result in double charging cost responsibility to heavy vehicles.

"Equity" is achieved in the traditional incremental method by providing highway facilities that give the same level of service to each class of user. Equity is measured by comparing the costs of providing the physical plant for each class of user, as determined from standard engineering design criteria. Maintenance costs should not be considered differentially in this approach, as they are accounted for in the incremental allocation of capital costs.

The basic concept of the new philosophy, however, is quite different. Rather than seeking an equity of providing "equal service" to each class of user, the intent is to charge for the "costs occasioned" from the direct use of the highway system, much as toll roads price their services. The concept is sometimes labeled the "consumption" approach and purports to charge an equal amount of cost responsibility for the "units of consumption" that each vehicle class contributes to the "wearing out" of the system.

Under this new concept, if vehicle size, weight, or use brings about a direct highway expenditure, then it can be considered to be an "attributable" cost and be "allocated" to the vehicle classes in proportion to the relative contribution made to the cause of the expenditure. Highway expenditures which are not "occasioned" by the direct use of the system are, by definition, considered to be "common costs" and should be shared equally by all vehicles.

Note that "common costs" of the consumption approach are different than the "basic costs" of the incremental approach. Common costs are, by definition, those costs <u>which do not reflect vehicle size, weight, or use.</u> Basic costs, on the other hand, are those costs which are occasioned in the provision of a highway facility for the <u>use of a basic vehicle.</u> There is no coincidence between the two and no reason they should be allocated on the same basis. The allocation procedures should therefore adhere to the specific definition of terms applicable to the philosophy of equity adopted.

The Kansas study did not adhere to this specific definition. On page 4 of the report, it is indicated that the Kansas study would follow the "incremental solution", and in many of the cost elements an incremental approach was taken. An important exception, however, is present in the allocation of pavement costs, where the traditional incremental approach was rejected. In this instance, the costs of a minimum pavement thickness were allocated as would be done in an incremental solution but the incremental costs were allocated as would be done in a "consumption" approach. It is this inconsistency of philosophy, within a given study, which defeats the purpose of HCAS, as there is no common basis for establishing that equity is achieved.

Allocation of Kanasas Highway User Taxes to Vehicle Classes:

In addition to problems related to the distribution of highway costs, there are obvious problems in the manner in which highway user taxes paid in Kansas are distributed among the various vehicle classes. The major problem stems from the assumption that the distribution of Kansas registered trucks in 1985-88 is the same as the distribution found by the Federal Highway Administration for Kansas in its 1982 Highway Cost Allocation Study. This assumption and the other assumptions spelled out on page 72, completely dominate the allocation of registration fees among the huge total of 38 different vehicle classes. This is exactly the kind of situation which the State of Virginia found in doing their highwaway cost allocation study, and the conclusion was that allocation in extensive detail was not possible based on the broad assumption that its vehicle populaton was the same as the FHWA population.

The trucking industry believes that this same situation exists in Kansas for two reasons. First, the operation of doubles or twin trailer combinations was extremely limited in the states east of the Mississippi River at the time of the 1982 federal highway cost allocation study. As a consequence, the doubles population in the study was extremely small. Secondly, several states still do not register by gross vehicle weight, so in order to develop gross vehicle weight registrations on a national basis, the Federal Highway Administration made very broad assumptions concerning the numbers of combinations in various weight categories in those states which did not register by gross vehicle weight. They had no data which supported their assumptions. A study conducted by Brad Statter of the American Trucking Associations, and reported to the Transportation Research Board meetings in 1984 produced conclusive evidence that the FHWA assumptions in these several states could not possibly be correct. No evidence has been produced to refute Mr. Statter's study. It is clear that the ratio developed by this inaccurate method in the FHWA study was carried over into the Kansas study for heavier vehicles. This use of percentage ratios devised in 1982, which were clearly inaccurate at that time, to determine the group of over 75,000 pound vehicles in 1985-88 in Kansas is not acceptable.

For these reasons alone, it was anticipated that the distribution of highway user taxes would be quite inaccurate among the 38 vehicle classes. Review of the findings in the summary tables of Chapter 4, reveals the kinds of strange results which were anticipated. For example, twin trailers over 75,000 pounds were found to pay only .39 of 1% of registration fees in Kansas, yet pay nearly twice as much .73 of 1% of all fuel taxes. At the same time these tables find 5-axle tractor semitrailers weighing more than 75,000 pounds pay 29% of all registration fees, yet contribute only 12.45% of all fuel taxes. These relationships make absolutely no sense and cannot possible be accurate in the real world of operation on the highways. Review of the tables reveals that the relationships in this study stem directly from the two assumptions which were questioned at the outset of this discussion. For example, the assumption that the 1982 federal data are absolutely accurate produces the finding in Table 2 that 5-axle tractor semitrailers registered for more than 75,000 pounds pay 97.5% of all prorate fees in Kansas. All other vehicles pay only 2.5%. Similar, though less easily quantifiable problems appear to exist in the distribution of fuel taxes, resulting in an understatement of actual fuel taxes paid by combination vehicles.

Conclusions:

The Kansas HCAS has followed several of the concepts of the recent Federal HCAS, and thus has elements which make highly questionable a claim that "equity" has been achieved. Nevertheless, from the purely pragmatic point of view, the method which was used to "allocate" the large pool of "administration" costs is largely responsibile for the finding that combination trucks, as a class, were presently paying only 79% of their cost responsibility.

The trucking industry objects to the allocation of administration costs on the basis of weight, as was done. Vehicle miles of travel is a more rational allocator, and if used for administration costs, results in combination trucks, as a group, presently paying their way.

As indicated in the tax analysis in this paper, the allocation to 38 vehicle classes is not based on sound, defensible data. In addition, the use of the Equivalent single axle load parameter for the assignment of certain pavement costs is a case in point. While the calculations made with this parameter are presented as exact mathematics, the equations which produce the factors are not precise at all. The rigid pavement equation, for instance, has a "correlation index" of only 0.16, indicating that it "explained" only 16 percent of the total change in rigid pavement condition observed at the AASHO Road Test. The flexible pavement equations also had major uncertainties associated with them.

The point is pertinent with respect to the "finding" that the "twin-trailer" combination is paying such a small portion of its cost responsibility (45%, Table 12, page 120). This finding is strongly dependent on the specific single-tandem equivalencies from the road test equations, particularly the flexible pavement equations. There are, however, major uncertainties relative to these relationships, as also exist with the present ESAL structure. The trucking industry has seen no proof that the axle load relationships, as represented by the ESAL calculations, are valid in the real world of pavement performance. In fact, many of the assumptions behind the ESAL calculations are involved in the major pavement research program being advanced by AASHTO and the FHWA. This should be considered "prima facia" evidence that the technology is not presently available to support such precise calculations of relative cost responsibility, as is done throughout the Kansas HCAS.

blank on purpose

KANSAS RAILROAD ASSOCIATION

920 S.E. QUINCY
P.O. BOX 1738
TOPEKA, KANSAS 66628

913-357-3392

PATRICK R. HUBBELL
SPECIAL REPRESENTATIVE-PUBLIC AFFAIRS

MICHAEL C. GERMANN, J.D.
LEGISLATIVE REPRESENTATIVE

December 27, 1985

The Honorable John B. Kemp
Secretary of Kansas Department
of Transportation
State Office Building
Topeka, Kansas 66612

Dear Secretary Kemp:

Thank you for providing us with a draft copy of the 1985 Kansas Highway Cost Allocation Study. This letter responds to your invitation for our review and comments. Lee Lane of the Association of American Railroads and his staff have assisted us in reviewing the study.

Generally, we believe the study presents a careful and balanced analysis of this complex issue. The study is well-documented and incorporates some important recent improvements in cost allocation technique, particularly in the treatment of pavement costs and overhead expenses. While our comments take issue with several points in the study, we advance them in the hope that they will help improve aspects of an otherwise sound analysis.

Our comments center on four areas:

The attribution of revenue to out-of-state heavy vehicles;

The definition and allocation of common costs;

The treatment of pavement maintenance costs; and

The minimum pavement thicknesses assigned as common costs.

Revenue Attribution

Table 10 on page 118 indicates that 3S2 combinations registered at 70-75 thousand pounds pay 42 percent of their cost responsibility while similar combinations registered at more than 75 thousand pounds pay 89 percent. On page 108 the study argues that the discrepancy is due to loading patterns: the lighter trucks carry more loads at the upper end of their registered weight range and their cost responsibility is thus nearly as high as that of the heavier category. However, this does not fully explain the extreme variation in the revenue/cost ratios. If cost responsibility were the same for both vehicle classes, the ratios would imply that user fees for the heavier trucks are twice as much per mile as for the lighter class. Yet the statutory tax rates are similar. Fuel tax payments per mile are nearly equal, and the registration fee for a 73,000 pound truck is only $150 less than that for a 76,000 pound truck according to Table 3 on page 8.

Problems in the apportionment of IRP and UPRA revenues may partly explain the wide difference in revenue/cost ratios. While Class 30 vehicles account for four times as much mileage as the lighter Class 29 trucks, they are credited with paying over 100 times as much in IRP and prorate revenue. Since IRP is at least in part a mileage based tax, it seems anomalous that such a difference should exist. The problem may arise in splitting IRP revenues among vehicle classes, with an excessive share going to Class 30. This would imply that the overall revenue/cost ratio of 80 percent (p. 120) for the classes combined 29 and 30 is a more reliable figure than the ratios for individual categories.

Common Costs

The common cost category primarily includes expenditures which are unrelated to the level or mix of traffic. Items such as the basic roadway, landscaping, snow and ice removal, and lighting are not affected by the level of use. Once funds are spent to provide these items, changes in the traffic level have no effect on their cost. The category also includes some direct costs such as motorist service or litter pickup, which are most closely related to VMT. These are not really common costs and should be treated independently.

Since there is no cost relationship to serve as a basis for allocating common costs, the choice of an allocator is a question of policy, not of technical judgment. Selecting VMT as the allocator favors heavy vehicles. Equally valid allocators such as axle-miles or ton-miles would have assigned heavy vehicles a larger share of these expenditures. In describing the 1982

Federal Highway Cost Allocation Study to a U. S. Senate Committee, FHWA Administrator Barnhart stated that the choice of VMT as an allocator "is somewhat arbitrary and was made in lieu of other travel measures which would have charged trucks more."

The Kansas study should explicitly state that the allocation of common costs is a policy decision, and that alternative allocators are also defensible.

In its discussion of alternative allocators on pages 5-6, the study implies that the choice of allocators will influence behavior, leading to changes in highway use, and then rejects some allocators because of the supposed influence. This discussion does not adequately distinguish between allocators and tax mechanisms. Behavior would shift only if the user charge system reflects the cost allocation decisions. For example, a user charge levied on the number of axles could tend to increase axle loads. Merely allocating costs on the basis of axle-miles would be unlikely to have a similar effect as long as user fees remain largely based on registered gross weight and fuel consumption.

Impacts on traffic patterns are not an important basis for selecting a common cost allocator. Shifts in traffic directly reflect changes in the user charge payments and the price elasticity of demand for each highway user. The most important influence of the allocator on this shift is the change in cost responsibility it causes, not the formula. Moreover, any shift in traffic caused by bringing user charges more closely in line with highway costs would be desirable.

Maintenance Expenditures

Attributable maintenance costs include expenditures for pavement repair. On page 22 the study states: "The ESAL-miles allocator would be conceptually acceptable for traffic related activities." We strongly agree. But the study instead lumps all attributable maintenance expenditures together and allocates them in proportion to axle-miles of travel.

It would be more accurate to select an appropriate allocator for each of the attributable cost maintenance activities. Pavement, shoulder, and bridge deck maintenance should be assigned in proportion to ESAL miles, striping and marking in proportion to axle-miles, and the remaining categories by appropriate allocators, depending on what activities they include.

Basic Roadway Costs

Ideally, the pavement increment allocated as the basic roadway would represent only costs unrelated to use. Load-related pavement capacity is a direct cost and should be allocated in proportion to ESAL miles. Only a basic roadway needed to resist the environment for a specified design life can properly be considered as the common cost element of pavement construction expenditures.

The "minimum design" roadway is really a surrogate for this common cost share of pavement costs. However, the basic roadway includes a significant share of load-related capacity. (Under typical circumstances the minimum used in the study could carry 80,000 ESAL during its service life.) Allocating this load-related capacity as a common cost penalizes light vehicles, which represent a far greater share of vehicle-miles of travel than of ESAL miles.

In the absence of precise estimates of the non-load share of pavement construction costs, the use of a design minimum is a valid approach. By its nature, the design represents a practical road with load-bearing capacity. No one would build the hypothetical minimum road which represents only common costs. To minimize the inaccuracy of assigning these direct, load-related capacity costs as common costs, the design minimum should provide the lowest possible load capacity. Minimum pavement designs for light-duty rural roads or parking lots may be more suitable for use in cost allocation than the relatively high-capacity AASHTO minimum.

In conclusion, despite our comments on certain aspects of the 1985 Kansas Highway Cost Allocation Study, we believe the study is generally sound and should offer the Legislature a useful guide in evaluating the need for changes in Kansas highway user fees.

Sincerely yours,

KANSAS RAILROAD ASSOCIATION

cc: Mr. Michael O'Keefe, Director
Division of Planning and Development
Kansas Department of Transportation
State Office Building
Topeka, Kansas 66612

Mr. Arland V. Hicks, Task Force
Leader, Cost Allocation Study
Division of Planning and Development
Kansas Department of Transportation
State Office Building
Topeka, Kansas 66612

blank on purpose

APPENDIX J
SUMMARY OF INTEREST GROUP COMMENTS

The task force categorized the comments submitted by the Kansas Motor Carriers Association and the Kansas Railroad Association. The comment categories included Common Costs, Pavement Maintenance Costs, Pavement Costs, Revenue from Heavy Out-of-State Vehicles, and Administration Costs. Table 1, "Summary of Comments on Kansas Highway Cost Allocation Study", lists the comments in side-by-side columns so that the summarized comments can be readily compared. The first column is the task force's draft position on a category. The second and third columns are, respectively, the comments of the Kansas Motor Carriers Association, and the Kansas Railroad Association. The fourth column is the task force's responses.

The Kansas Railroad Association stated that the minimum pavement thickness should be the thickness of a light duty rural road or a parking lot. A typical thickness of a light duty rural road or a parking lot is about 3 inches. The task force used 6 inches as the minimum pavement thickness because 6 inches is the minimum design pavement thickness for the lowest volume roads on KDOT's system.

The Kansas Motor Carriers Association suggested that administration costs should be allocated on the basis of vehicle miles traveled (VMT). If administration costs were allocated on the basis of VMT, passenger vehicles would be responsible for 88.49% with trucks responsible for the remaining 11.51%. The task force considered administration costs to be on overhead cost inasmuch as they are either not affected or only marginally by changes in vehicle travel. The overhead costs were originally prorated in the same proportion as the allocated costs of construction and maintenance which allocated 59.19% to passenger vehicles with trucks responsible for the remaining 40.81%. Even though the task force did not adopt the VMT allocator, the task force now believes (and opted) that ALL allocable costs should be used in the proration of administration costs. Administration costs will NOW be prorated to the various classes of vehicles in the same proportions as the allocated costs of Construction, Maintenance, Division of Motor Vehicles, and Freeway Debt Service. Passenger vehicles will now be responsible for 59.72% of administration costs with trucks responsible for the remaining 40.28%. The net effect of this change is to transfer 0.73% of administration costs from trucks to passenger vehicles.

Comments received from the Kansas Railroad Association would shift cost responsibility from passenger vehicles to trucks. Comments received from the Kansas Motor Carriers Association would shift cost responsibility from trucks to passenger vehicles. Table 2, Comparative Ratios of User Charges Paid to Cost Responsibility - Combined Vehicle Types", displays the ratios which would result from adopting the interest group comments. Trucks would underpay 30% if the Kansas Railroad Association comments were adopted. Trucks would overpay 4% if the Kansas Motor Carriers Association comments were adopted. The task force's study lies between the extremes with a truck underpayment of 18%. The "1982 Federal Highway Cost Allocation Study" shows a truck underpayment of 21%. Therefore, the task force believes its results reasonable and fair to competing interest groups.

TABLE 1
COMMENTS ON KANSAS HIGHWAY COST ALLOCATION STUDY

TASK FORCE	KANSAS MOTOR CARRIERS ASSOCIATION	KANSAS RAILROAD ASSOCIATION	TASK FORCE RESPONSE
VMT Allocator for Common Costs Common Costs are a form of measurement determining the need of a roadway facility with no relationship to weight, width, or other vehicle characteristics. The relative need can be measured by numbers of vehicles (N), vehicle miles traveled (VMT), and axle miles traveled (AMT).	VMT Allocator for Common Costs No comment.	VMT Allocator for Common Costs No cost relationship exists to serve as a basis for allocating common costs. The selection of vehicle miles traveled (VMT) favors heavy vehicles. Equally valid allocators could have been axle miles traveled (AMT) or ton miles traveled (TMT). The Kansas study should explicitly state that allocation of common costs is a policy decision, and that alternative allocators are also defensible.	VMT Allocator for Common Costs Task force agrees that alternative allocators of common costs exist and rational defense can be made. Task force allocated common costs of bridges on the basis of axle miles traveled (AMT). Task force considered the costs of Drivers Licensing and Vehicle Registrations to be a common cost allocated on the basis of number of vehicles (N).
Allocation of Attributable Pavement Maintenance Costs All vehicles will be responsible for attributable cost activities on the basis of ton miles traveled (TMT). Attributable cost activities include such activities as pavement, shoulder, and bridge maintenance. These activities are affected by weight and axles.	Allocation of Attributable Pavement Maintenance Costs No comment.	Allocation of Attributable Pavement Maintenance Costs Pavement, shoulder, and bridge deck maintenance costs should be allocated on the basis of equivalent single axle loadings miles (ESAL-miles).	Allocation of Attributable Pavement Maintenance Costs The use of equivalent single axle loadings miles (ESAL-miles) was considered but not adopted because KDOT consensus was that such use would over emphasize weight. However, precedent for such use exists. The State of Oregon uses ESAL-miles for allocation of 90% of pavement maintenance with the remaining 10% by axle miles traveled (AMT).
Allocation of Pavement Costs The minimum pavement method will be used for allocation of pavement costs. In the minimum pavement method, a pavement is first designed for all anticipated traffic. Next, the thickness of a minimum pavement sufficient to resist the environment and to provide limited service to a minimal number of light vehicles is established. The minimum pavement is allocated to all vehicles on the basis of vehicle miles traveled (VMT). The remaining thickness is allocated to all vehicles on the basis of equivalent single axle loadings (ESAL's). The task force investigated	Allocation of Pavement Costs The incremental method should be used for allocation of pavement costs.	Allocation of Pavement Costs Concurrence with the Task Force.	Allocation of Pavement Costs As in the case of other new facilities, the allocation of pavement costs is based on vehicle characteristics that determine the need for the pavement. The traffic-related basis for designing pavements is the anticipated passage of axle loads of each weight and type during a design period (usually 20 years). In accordance with current pavement design theory, a passage by an axle of any given weight is translated into an equivalent number of passages of an axle weighing 18 kips (18,000 pounds) determined in accordance with the AASHO Road Test Equations. Thus, each axle is assigned an 18-kip equivalent single axle load (known simply as "ESAL Value"). Even though the ESAL Value varies depending on several pavement design parameters, ESAL's are considered additive for any given pavement design and the number of anticipated cumulative ESAL's is used as the sole traffic-related variable in pavement design. Both the incremental method and the minimum pavement method use the AASHO Road Test Equations in some way to determine cost assignment.

TABLE 1 (Continued)
COMMENTS ON KANSAS HIGHWAY COST ALLOCATION STUDY

TASK FORCE	KANSAS MOTOR CARRIERS ASSOCIATION	KANSAS RAILROAD ASSOCIATION	TASK FORCE RESPONSE
the traditional incremental method before selecting the minimum pavement technique. In the traditional weight added incremental method, a pavement is first designed for all anticipated traffic. Next, a design is made assuming all axle load applications are converted to equivalent 3,000 pound axle loads using tables developed from AASHO Road Test data. Successive calculations are made for 20,000, 16,000, 12,000, and 7,000 pound increments. In these calculations, all axle loads above the appropriate increment are reduced to its upper weight value. All axle loads within each increment are increased until they are equal to the upper boundary of that increment. The actual average maximum axle load is used for the boundary of the upper increment. The design values are then converted into equivalent pavement layers. Finally, costs are assigned to each pavement layer for each increment.			The traditional incremental method subsidizes heavier axle loadings at the expense of lighter axle loadings. As an example, an axle loading of 16,100 pounds would have the same cost responsibility as an axle loading of 19,900 pounds since both loadings are contained within the 16,000 to 20,000 increment. However, the heavier loading is 23.6% greater than the lighter loading. The difference is a cost responsibility subsidy from lighter loadings to heavier loadings within a weight increment. The effect of this upper rounding is most pronounced in the lighter increments. The minimum pavement method resolves the subsidy problem through the allocation of cost of the thickness above a minimum thickness (the non-load or environmental share) on the basis of equivalent single axle loadings (ESAL's) to all vehicles. Pavements are designed for a given service life on the basis of accumulated ESAL's without regard to the vehicle contributing the ESAL's. Vehicles, then, have a cost responsibility for their ESAL contribution to the traffic stream. Not only does this resolve the subsidy situation, it also shares the economy of scale for pavement costs and the exponential increase in pavement strength with pavement thickness equitably with all vehicles.
Common costs for pavements are the costs of a minimum design thickness sufficient to resist the environment and to provide service for a minimal number of vehicles.	Common costs, by definition, are those costs which do not reflect vehicle size, weight, or use.	Common costs for pavements should include only those costs needed to resist the environment for a specified design life.	Task force agrees. However, thickness required to resist environment only is difficult to establish. For that reason, the task force considered the minimum design thickness to be a common cost.
The thickness of a minimum pavement is consistent with AASHTO and KDOT design practices.	No comment.	The thickness of a light duty rural road or a parking lot may be more suitable.	The task force used the minimum design pavement thickness for the lowest volume roads on KDOT's system as the pavement thickness of the basic road.

TABLE 1 (continued)
COMMENTS ON KANSAS HIGHWAY COST ALLOCATION STUDY

TASK FORCE	KANSAS MOTOR CARRIERS ASSOCIATION	KANSAS RAILROAD ASSOCIATION	TASK FORCE RESPONSE
<u>Revenue Attribution of Heavy Out-of-State Vehicles</u> The IRP and UPRA revenues were attributed to vehicle classes using the following assumptions: 1. Foreign based Interstate vehicles will be in the same proportion as Kansas based vehicles. 2. Mileage for both foreign and Kansas based vehicles is proportional to total Kansas mileage by vehicle type. 3. Kansas registration weight group fees, even though not identical to other states, are a surrogate measure of registration weight group fees.	<u>Revenue Attribution of Heavy Out-of-State Vehicles</u> Foreign based interstate vehicles are not in the same proportion as Kansas based vehicles. The assumption distorts the actual attribution. In addition, the assumption also results in an understatement of fuel taxes paid by combination unit vehicles.	<u>Revenue Attribution of Heavy Out-of-State Vehicles</u> Problems exist in the apportionment of IRP and UPRA revenues to individual truck type and weight categories. An excessive share is assigned to type 30 - CU 3S2 > 75. The combination of type 30 with type 29 - CU 3S2 70-75 gives a more reliable figure.	<u>Revenue Attribution of Heavy Out-of-State Vehicles</u> The task force agrees it is difficult to apportion IRP and UPRA revenues to individual truck type and weight categories. Revenues are collected and recorded by registration weights. However, cost responsibility is allocated to truck types on the basis of axles, axle loadings, and types of trailers. The assumptions used to apportion IRP and UPRA revenues, while not exact, were the best available for the study.
<u>Allocation of Administration Costs</u> Administration costs were considered to be overhead costs inasmuch as they are either not affected or only marginally by changes in vehicle travel. The overhead costs were prorated to the various classes of vehicles in the same proportion as the allocated costs of construction and maintenance expenditures.	<u>Allocation of Administration Costs</u> Administration costs are not related to vehicle characteristics. Therefore, administration costs should be allocated on the basis of vehicle miles traveled (VMT).	<u>Allocation of Administration Costs</u> The treatment of administration costs incorporates some recent important improvements in cost allocation.	<u>Allocation of Administration Costs</u> The task force agrees that administration costs are not related to vehicle characteristics. The task force believed the reason for administration was to provide support to construction and maintenance. However, the task force now believes that <u>ALL</u> allocable costs should be used in the proration of administration costs. Administration costs will now be prorated to the various classes of vehicles in the same proportions as the allocated costs of Construction, Maintenance, Divison of Motor Vehicles, and Freeway Debt Service.

TABLE 2
COMPARATIVE RATIOS OF USER CHARGES PAID TO
COST RESPONSIBILITY - COMBINED VEHICLE TYPES

FHWA VEHICLE TYPE	KRA ALLOCATE 1985-88 COMBINED COSTS PERCENT	KDOT ALLOCATE 1985-88 COMBINED COSTS PERCENT	KMCA ALLOCATE 1985-88 COMBINED COSTS PERCENT	USER CHARGES PAID PERCENT	KRA RATIO OF USER CHARGES PAID TO COST RESPONSIBILITY	KDOT RATIO OF USER CHARGES PAID TO COST RESPONSIBILITY	KMCA RATIO OF USER CHARGES PAID TO COST RESPONSIBILITY	FHWA RATIO TABLE VI-10 1982 FEDERAL STUDY
1 Standard Auto	22.53%	25.70%	29.84%	31.50%	1.40	1.22	1.06	1.21
2 Small Autos	11.97	13.18	15.72	12.31	1.03	0.93	0.78	0.70
3 Motorcycles	0.70	0.72	0.79	1.36	1.95	1.89	1.73	0.46
4 Intercity Buses	0.15	0.12	0.10	0.09	0.60	0.73	0.86	1.16
5 Other Buses	0.97	0.72	0.61	0.34	0.35	0.46	0.55	0.33
6 Pickups/Vans	16.56	19.15	21.03	21.24	1.28	1.11	1.01	1.23
7 SU Trucks <26	5.08	5.05	4.35	5.46	1.08	1.08	1.25	1.31
8 SU Trucks >26	5.48	4.61	3.73	3.48	0.64	0.76	0.94	1.74
9 CU Trucks <50	1.60	1.57	1.27	1.17	0.73	0.75	0.92	0.84
10 CU Trucks 50-70	3.96	3.47	2.74	3.31	0.84	0.96	1.21	0.85
11 CU Trucks 70-75	6.03	4.91	3.80	2.05	0.34	0.42	0.54	0.60
12 CU Trucks >75	24.97	20.79	16.01	17.69	0.71	0.85	1.10	0.45
Totals	100.00%	100.00%	100.00%	100.00%	1.00	1.00	1.00	1.00
1 Autos	34.50%	38.88%	45.56%	43.81%	1.27	1.12	0.96	1.10
2 Motorcycles	0.70	0.72	0.79	1.36	1.95	1.89	1.73	0.46
3 Buses	1.11	0.85	0.71	0.43	0.38	0.50	0.60	0.51
4 Pickups/Vans	16.56	19.15	21.03	21.24	1.28	1.11	1.01	1.23
5 SU Trucks	10.56	9.67	8.08	8.94	0.85	0.93	1.11	1.51
6 CU Trucks	36.57	30.74	23.83	24.21	0.66	0.79	1.02	0.59
Totals	100.00%	100.00%	100.00%	100.00%	1.00	1.00	1.00	1.00
1 Pass. Vehicles	52.87%	59.60%	68.09%	66.84%	1.26	1.12	0.98	1.11
2 Trucks	47.13	40.40	31.91	33.16	0.70	0.82	1.04	0.79
Totals	100.00%	100.00%	100.00%	100.00%	1.00	1.00	1.00	1.00

KRA = Kansas Railroad Association
KDOT = Kansas Deparatment of Transportation
KMCA = Kansas Motor Carriers Association
FHWA = Federal Highway Administration

JOHN C. BOTTENBERG
412 CAPITOL TOWER — 400 W. 8TH
TOPEKA, KANSAS 66603
(913) 235-2324

February 19, 1987

The Honorable Rex Crowell
Chairman, House Transportation Committee
State House
Topeka, Kansas 66612

Dear Chairman Crowell:

On behalf of the Kansas Ethanol Association I am requesting the House Transportation Committee to introduce a bill establishing the Kansas Produced Ethanol Incentive Fund.

Current law allows 3 cents per gallon tax exemption for qualified ethanol gasoline blends. This exemption goes to 2 cents on July 1 of this year.

At the 2 cent rate the state hiway fund will lose approximately $4.8 million in fiscal year 1988. If oil prices continue to increase the lost revenue would increase substantially.

Under the current law the largest share of the exemption flows to out of state producers.

The Kansas Ethanol Association's proposal would provide an incentive for the gasoline blenders to use Kansas produced ethanol in Kansas.

The advantages to the state would be:

1. Market for Kansas Grain
2. $4.8 maximum of hiway monies.
3. Employment Opportunities by assuring an in-state market for Kansas Produced Ethanol.

Indiana, Louisiana, Utah, and Virginia are using this approach to promote economic development within their state.

I would appreciate your favorable consideration on this request.

Sincerely,

John C. Bottenberg

John C. Bottenberg

Attach. 3